

GASOLINE ENGINES



INTERNATIONAL HARVESTER
COMPANY OF AMERICA
(INCORPORATED)
CHICAGO, U.S.A.

The Utility of the Gasoline Engine

THE development of the gas engine is the result of the necessity for a power which is more convenient, practical, adaptable and economical than hand, horse, wind, water, steam or electrical power. Although the prevailing impression in the mind of the general public is that the internal combustion engine is a comparatively recent invention, quite the opposite is actually the case, for internal combustion engines were introduced almost 100 years before steam engines. With the introduction of steam, however, the efforts of scientific men and inventors were directed to the development and application of this power, with the result that the development of the internal combustion engine was allowed to remain practically at a standstill. It was not until 1860 that the first really practical internal combustion engine was brought out. Since then its advancement has been remarkably rapid.

Today we find the gasoline engine everywhere—multiple cylinder engines in units of 5000-horse power

or more for large industrial plants; high speed gasoline engines for automobiles and marine craft; gasoline tractors and stationary and portable engines of all sizes and kinds for farm, shop and mill use.

The field of usefulness for the latter class of engines—stationary and portable from 1 to 25-horse power—is practically unlimited. Every farmer in this country needs a gasoline engine, aptly termed “the best hired man.” This power is likewise adapted for use in grain elevators and feed mills, cotton gins, grist and saw mills, for pumping and irrigation, water-works and electric lighting plants, and in shops of every description where a small power will answer.

For the purposes enumerated above, no line of gasoline engines has given more universal satisfaction under all conditions than the International Harvester Company line. These engines are made in many styles and in sizes from 1 to 25-horse power.

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Important Points to be Considered Before Purchasing an Engine

The amount of power required for the work to be done is a very important consideration when buying a gasoline engine. No matter what style of engine is to be purchased, it is by all means advisable to figure upon a unit somewhat larger than at first seems necessary. More work is sure to develop than was at first contemplated. It is always well to have a little power in reserve because an engine laboring under an excessive overload loses money for the owner very rapidly in fuel consumed and wear and tear on the engine. If the engine is to be used in a fixed location for driving a number of machines, the following formula is an excellent one to determine the horse power to purchase.

The horse power of the engine should be equal to that required by the largest machine driven, plus 25 to 50 per cent of the power required by the remainder of the machines to be driven. Allow 25 per cent where the machines are not to be driven simultaneously, and 50 per cent where several machines are to be driven simultaneously with the largest. Where all the machines driven are to be operated at the same time, add together the horse power required by the various machines, and purchase an engine with a horse power equivalent to the total.

The style of engine to be selected is determined by the location and the nature of the work to be performed. If the engine is used in a fixed location a stationary type answers; if it is to be used at various points a portable type mounted on skids, sleigh runners or wheels is desirable; while for hauling loads as well as for transmitting power from the crank shaft to the machine, a tractor should be used.

The selection of the right type of engine is fully as important as the selection of the right make. The entire field should be studied very thoroughly before purchasing. If an engine is to do good work, the design must be reasonably correct, and both workmanship and material must be first-class in every particular. A high polish and fancy paint are desirable, but these standing alone tell very little of the real value of the product.

Ordinarily the best piece of mechanism contains the smallest number of parts to do the work properly. These parts must be arranged so that they are readily accessible and easy to remove. The best piece of machinery ever built, however, will run into misfortune occasionally, and will eventually wear out. When repairs are necessary in such cases the importance of having bought a machine which has been standardized is fully realized by the purchaser. Repairs should be located at convenient points within a few hours of every machine, because delay waiting for repairs usually proves expensive.

The purchaser of an engine should be sure that the design of his engine adapts it for use indoors—the plan of erection should be such that the insurance company will permit its use. Thus the least fire risk is taken.

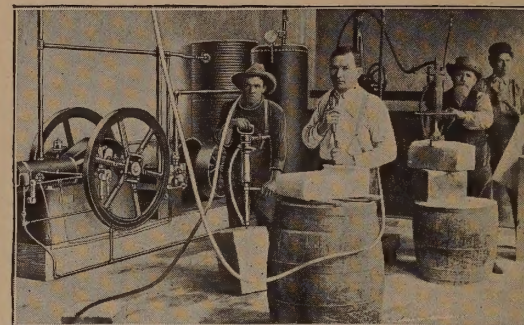
It is important to bear in mind that the rated horse power of an engine is not always a reliable basis for comparison with the actual power possible to get from the engine. Many engines on the market rated at 5-horse power will hardly do more and perhaps not as much as 5-horse power under regular operating conditions, while other engines built by reputable manufacturers will deliver continually and satisfactorily a load as great as 20 per cent above their rating. If there is any doubt in the mind of a purchaser as to the power possible to get from the engine under consideration, he should insist upon proof of the actual brake horse power.



Operating a milking machine.



Pulling a road grader.



Operating an air compressor in a marble works.



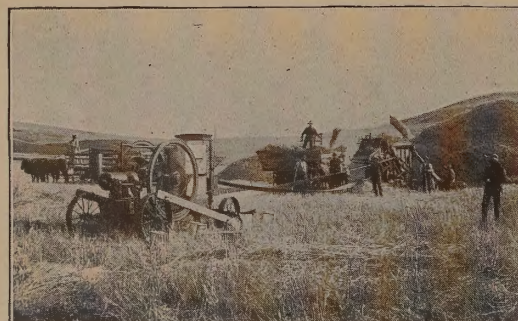
Furnishing power in a manual training school.



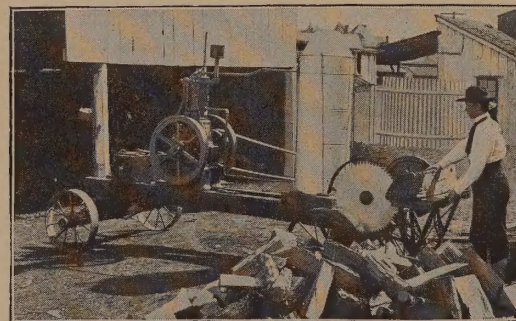
Installed in a typical southern farm power house.



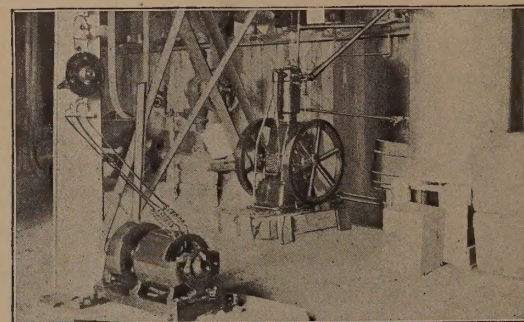
Operating a concrete mixer.



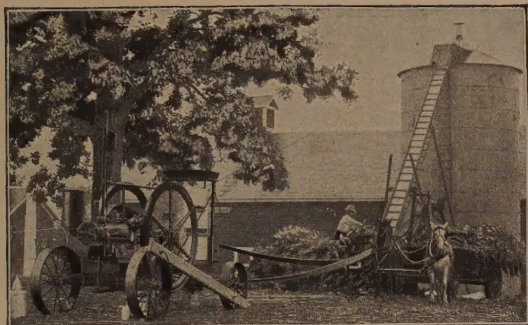
Operating a Belle City thresher.



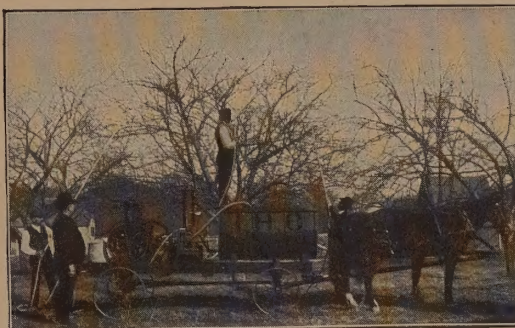
Sawing wood.



Operating a small dynamo.



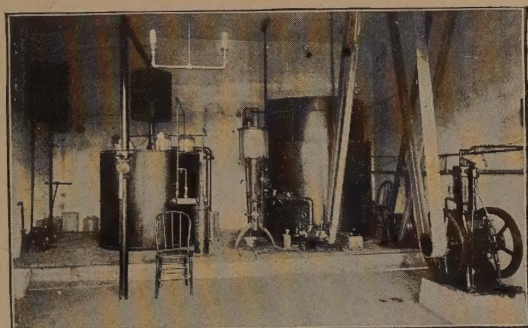
Cutting and elevating fodder.



Spraying engine at work in an orchard.



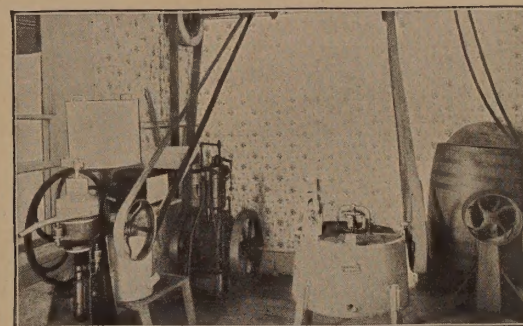
Operating a broom corn machine.



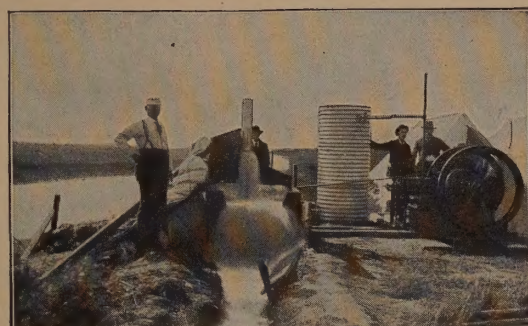
Installed in a city gas plant.



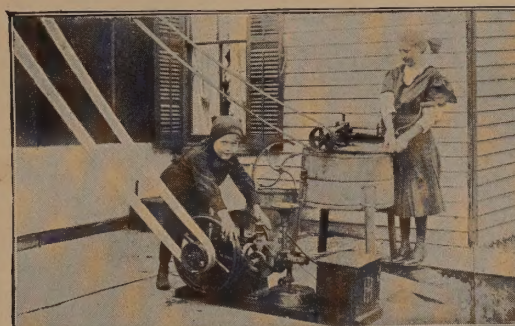
Pumping water for irrigation.



Supplying power in a dairy.



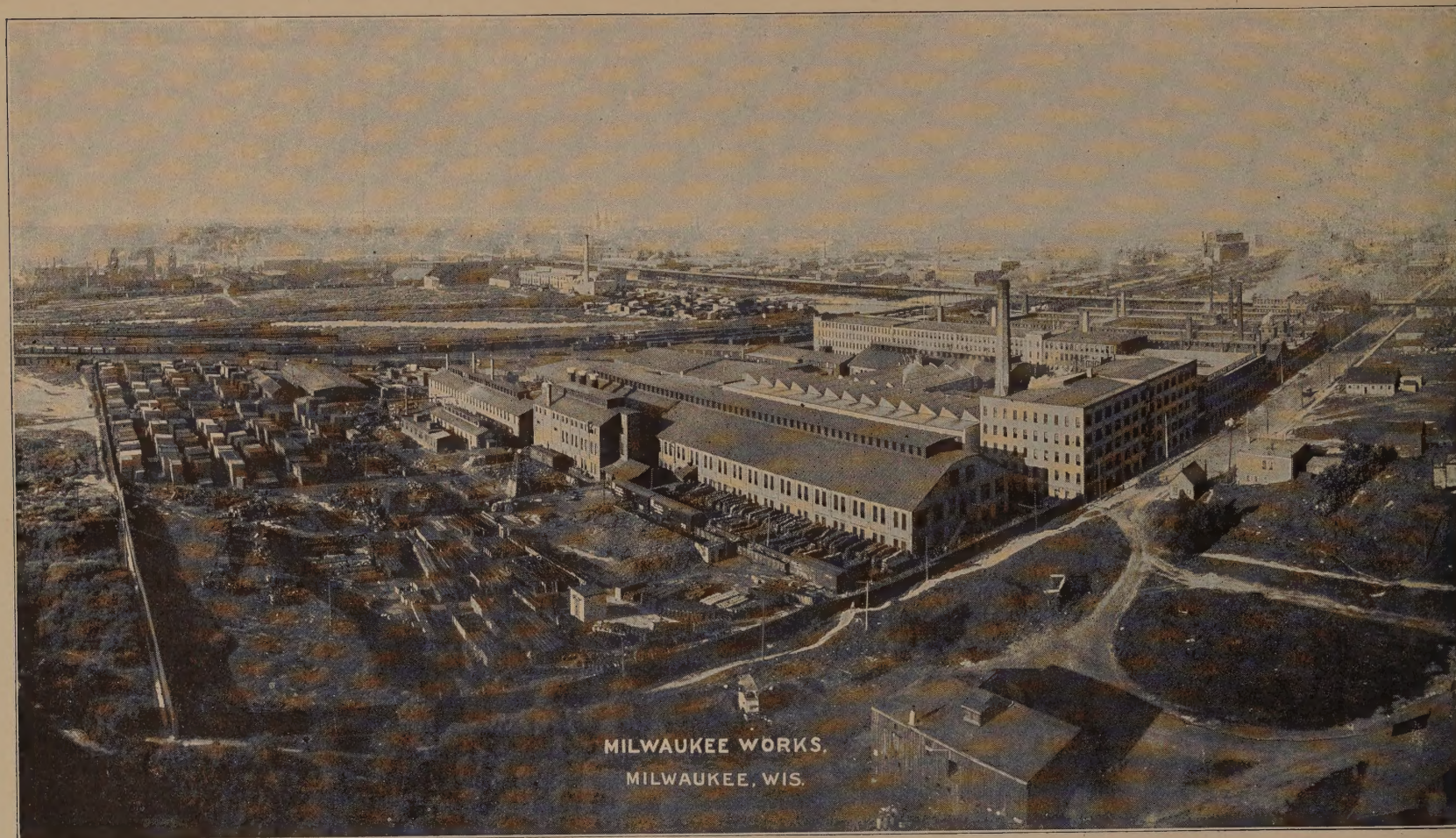
Pumping water for irrigation.



Operating a washing machine.

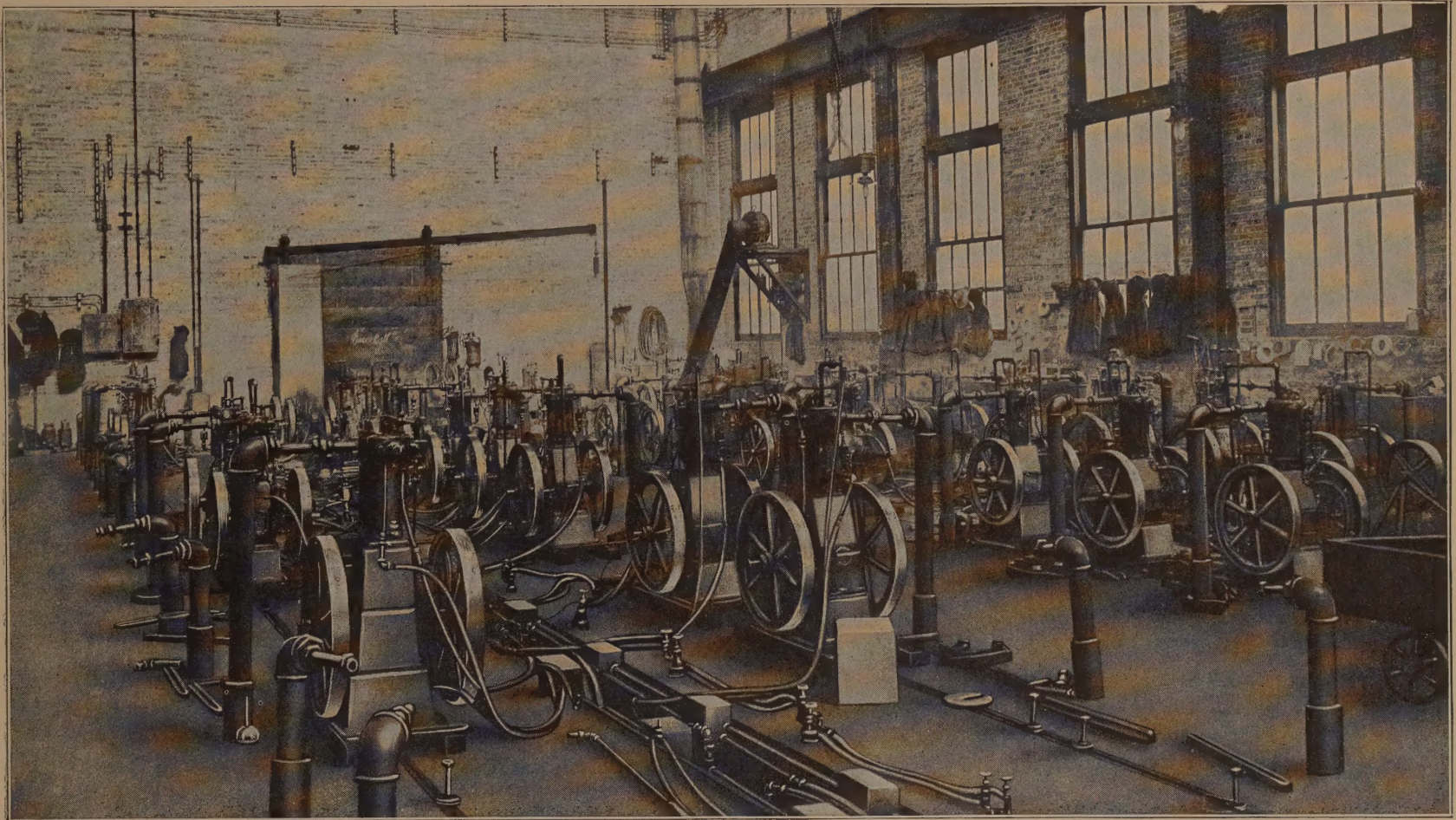


Furnishing power in a print shop.



Where I. H. C. Gasoline Engines are Made

The illustration presented herewith is a photographic reproduction of the Milwaukee Works, located at Milwaukee, Wisconsin, where International Harvester Company gasoline engines are manufactured. This plant includes 27 buildings and covers a total of $25\frac{3}{4}$ acres. The total floor area of the buildings is 613,807 square feet, which if arranged on the basis of a single building one story high and 25 feet wide would mean a building $4\frac{9}{10}$ miles long. It is a modern plant in every respect. The average number of workmen employed at this plant throughout the year is about 3,000.

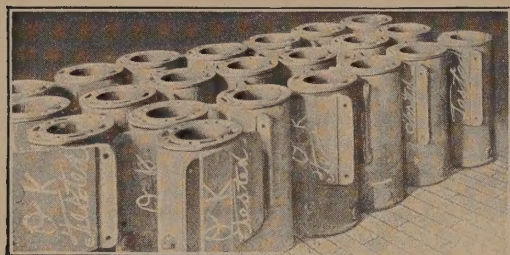


Interior View of One of the Large Testing Buildings Showing How I. H. C. Vertical Engines are Tested

Testing Buildings

One of the most interesting group of buildings in this great plant is the testing group, which comprises three one-story brick buildings, 328 feet long, averaging 57 feet in width. These three buildings are equivalent to a one-story building 25 feet wide and 749 feet long, containing 17,546 square feet. In these testing buildings every gasoline engine manufactured at this plant is thoroughly tested before being packed and shipped. Every engine is made to run at a stated horse power for a specified time, so that when the engine is finally packed and shipped it must be right working in every detail and up to the I. H. C. standard.

How I. H. C. Quality is Guaranteed



Tested Cylinders

Every purchaser of a gasoline engine has a right to expect a positive guarantee that the engine he purchases is absolutely reliable in every particular. An engine may be manufactured of the best materials, the most approved mechanical equipment may be used, expert workmen may be employed, but when the engine is completed no man can say that the engine is absolutely reliable. It takes a practical and thorough working test to demonstrate the reliability of the engine. Of course, if the engine is built in the most conscientious manner, a superior product should naturally result. Slight defects, however, which would impair the efficiency of the engine are unavoidable, and the only way to be certain that no engine sent out has any of these unavoidable defects is to test each engine carefully.

This explains why every I. H. C. gasoline engine is given an actual working test of ten hours in the large testing buildings designed especially for this purpose. These buildings are equipped with the most modern testing apparatus. They are under the management of gas engine experts, and, as only the most thorough methods are practiced, it is impossible for a defective engine to leave the works.

Every part of each I. H. C. gasoline engine is inspected time and again, both before and after testing, so that when the master inspector finally attaches his approved tag to the engine, there is little chance that any defect, however slight, has been overlooked.

On this and the following page are reproduced the tags which are used in the course of testing I. H. C. engines. These tags tell the story almost better than any words which might be said.

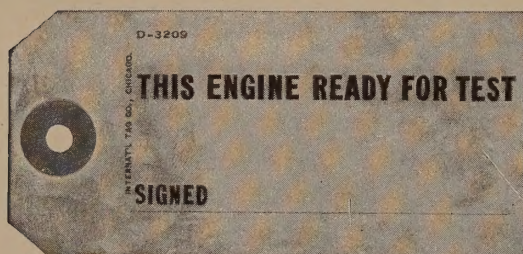
In the first place the engine is assembled in the erecting room. When completed, tag No. 1 is attached to the mixer. This tag states that the engine is ready for testing. To be absolutely sure, however, that the engine is correctly assembled two inspectors from the testing department examine the engine before it leaves the erecting floor, and if they find it OK they punch the tag twice, remove it from the mixer, and attach it to the cylinder head.

This indicates that the engine has been examined and found satisfactory for testing, so that it is ready to be removed to the testing floor.

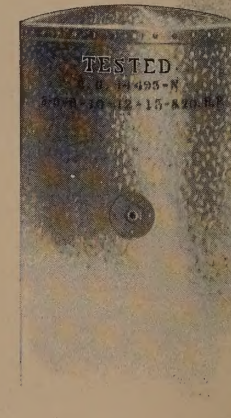
It is evident that the utmost care is exercised from the moment the parts of the engine are assembled until delivered for test.

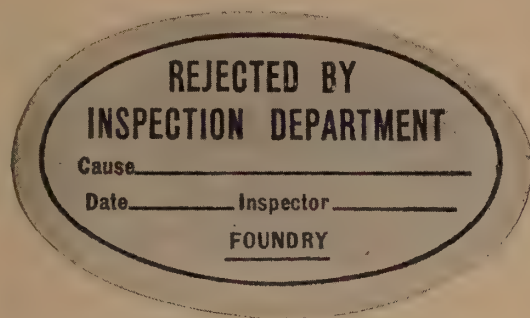
When the engine is delivered to the testing department it is placed on the block and all connections made by assistant testers. It is then carefully inspected to be sure that the valves, ignition, etc., are properly timed.

After these adjustments are made, the engine is started and allowed to run idle for an hour.



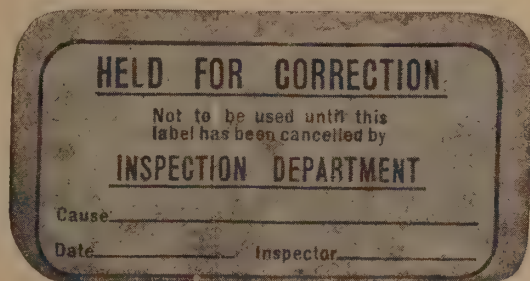
No. 1





Then a light load is put on it, which is gradually increased to full load. For four hours the engine runs under maximum load. A brake test is then made to examine the exact horse power which it is capable of developing. This being found satisfactory, the fuel consumption test is made by the official tester, as well as a further test for maximum load. A record is made of the engine; the valves are marked for starting and full load, and the engine is then ready for the master inspector.

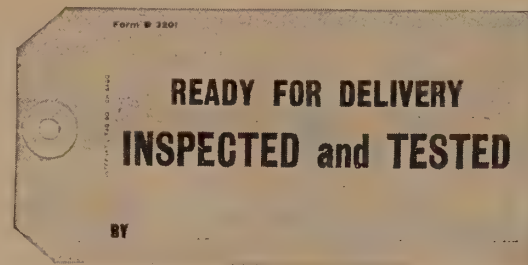
It is the duty of the master inspector to examine every detail of the engine. When it receives his approval, tag No. 2, reading "Ready for Delivery; Inspected and Tested," which is signed by the inspector, is attached to the engine. It is then ready for the paint shop. If during this thorough testing any casting is found defective, a tag is attached to it reading "Rejected by Inspection Department." This indicates that the part must be scrapped and a perfect part supplied. If the engine should develop a defect due to machining, that part is also tagged, rejected and scrapped. If a defect of any other nature should develop which would impair the right working of the engine, that part is tagged "Held for Correction." This tag cannot be removed from the engine until the defect has been remedied and approved by the chief inspector, who cancels the tag.



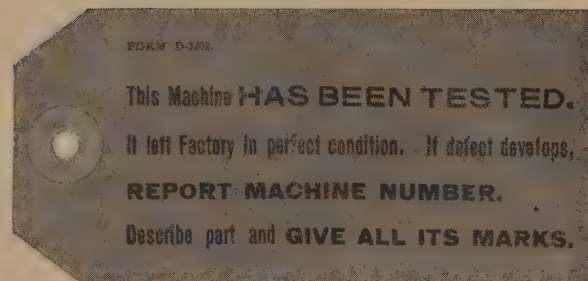
After testing, the engine is delivered to the paint shop. Before it is painted, two inspectors look over all parts very carefully. If they find everything satisfactory, the testing department tag is removed from the engine, and in place is attached tag No. 3, which reads "This Machine has been Tested. It left Factory in Perfect Condition. If Defect Develops, Report Machine Number, Describe Part and Give all its Marks." This tag remains on the engine until it is delivered to the purchaser.



This outline of the manner in which I. H. C. engines are tested is convincing evidence that no imperfect engine can leave the works.

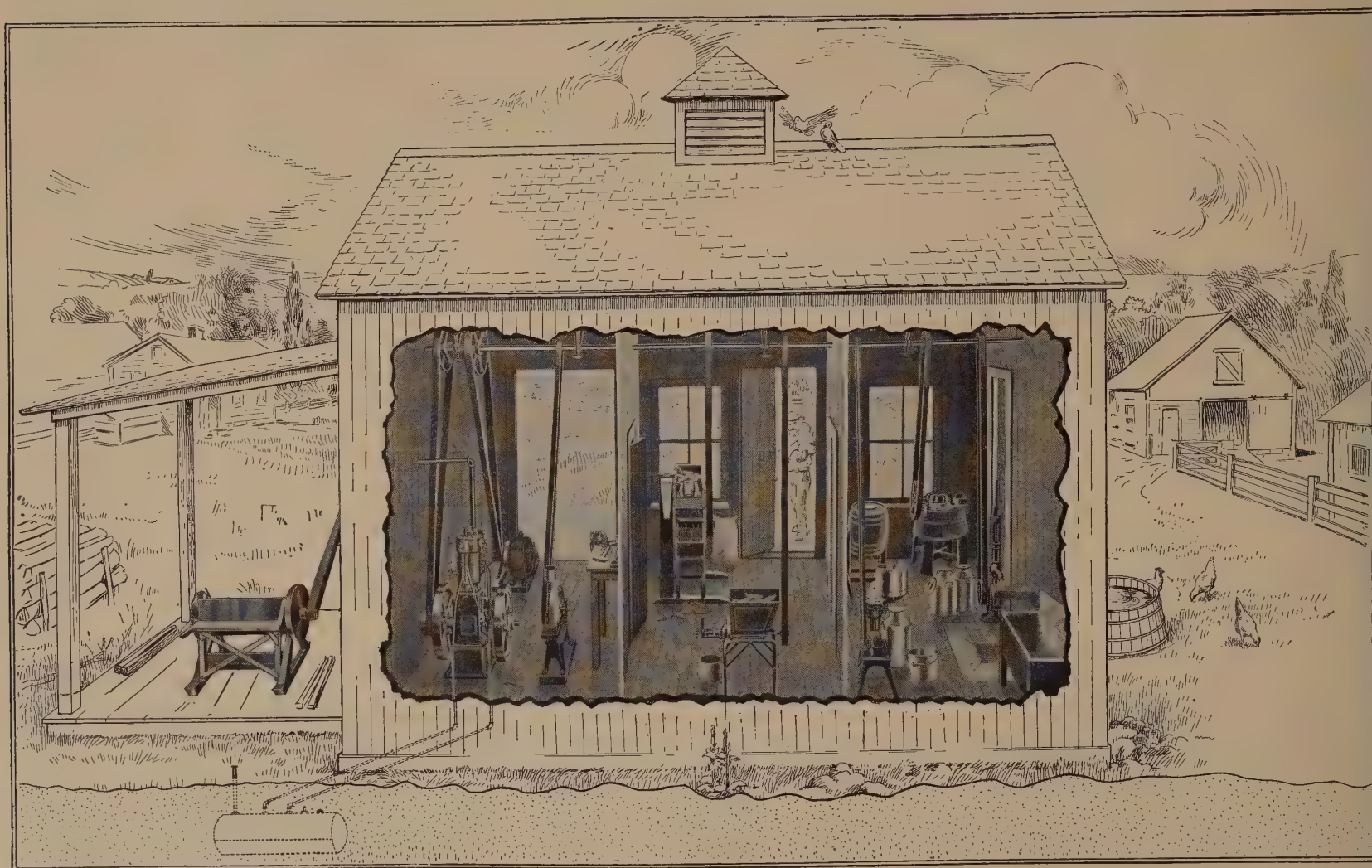


No. 2



No. 3

A PRACTICAL FARM POWER HOUSE



How to Install a Power House on the Farm

In planning a power house on the farm there are certain general principles which should be followed. In the first place, as the engine is the most important machine, it should be installed in a separate room, shut off from the remainder of the power house. The engine should be so placed that all sides of it are accessible—at least three feet from any wall—and should be in a well-lighted, well-ventilated room, one that can be heated in the winter time. If the engine is crowded into a corner, it is impossible to get at all the parts, either for cleaning or repairing, so that the outfit becomes a source of inconvenience.

The gasoline tank should be located outside of the engine room about 30 feet distant. If this tank is properly installed in the ground, it will be insurance against fire risk, and it will be kept cool in summer, so that the gasoline will not evaporate.

In the engine room might be located the grindstone, emery wheel, drill and work bench so that this room becomes a workshop. If a dynamo is used to furnish light for the house, it can also be located in this room.

The remaining space in the power house should be divided into two rooms. In one room locate the grinder, sheller, cutter and fanning mill. The grinder and sheller might be located close to a window so that it is possible to unload from the wagon through the window into the machine. The room containing these machines should be tightly partitioned off from the rest of the building because these machines when in operation create dust, which would interfere with the successful operation of other machines.

In the third room can be located the churn, cream separator, washing machine, pump and drain, dairy table and a large washing trough. This room then becomes the dairy.

All these machines in the power house should be driven by belt from line shafting which is set overhead or hung from the ceiling.

When an engine of 4-horse power or less is installed 1½-inch iron shafting will be found adequate. If a larger engine is installed, 2-inch iron shafting should be used. Shafting, pulleys, hangers and belts can be purchased in all towns and small cities from the hardware merchant, while in larger cities these supplies are furnished by iron and steel supply houses.

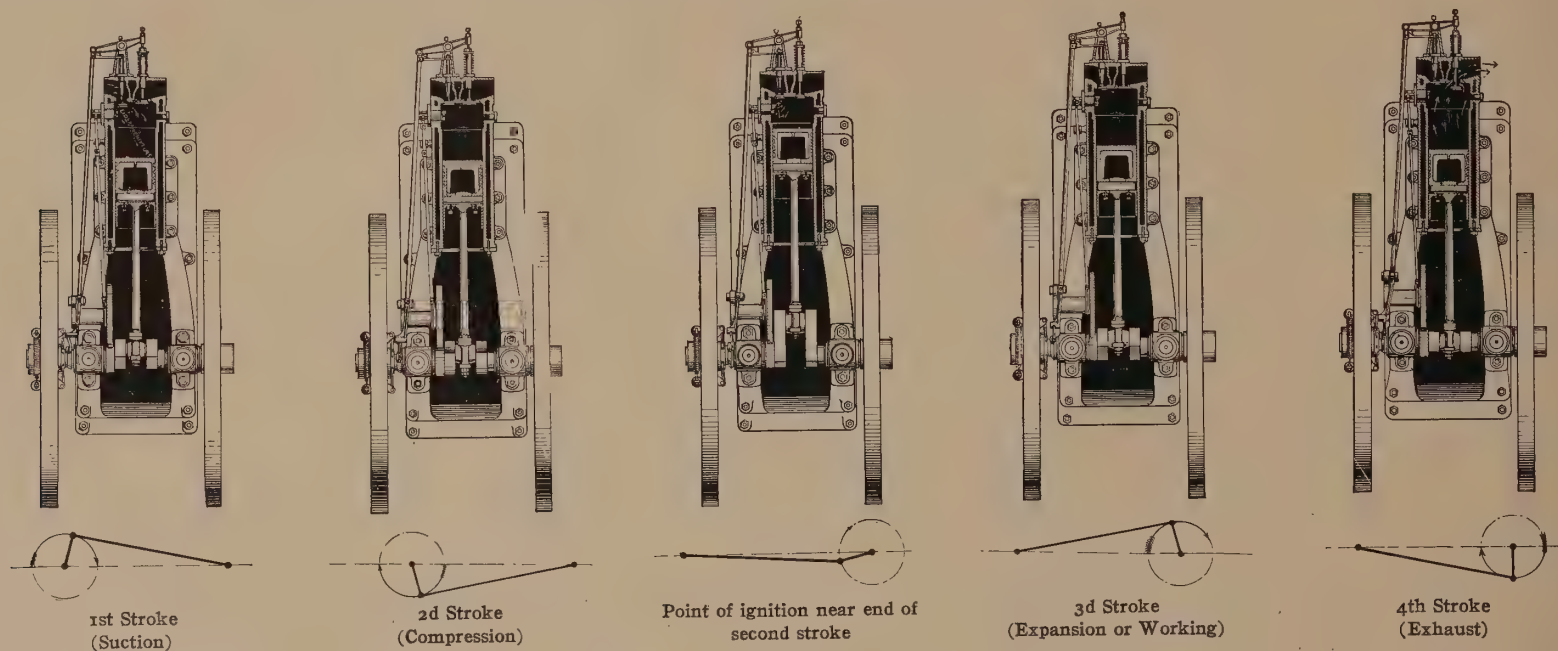
All high speed machines should be firmly bolted to the floor and operated by their own belts, while other machines can be moved so that one or two belts will answer for driving all of them; that is, if they are not to be driven simultaneously. Locate the machines as near the line shafting as possible in order to avoid long belts. The center line of the engine must be exactly at right angles to this shafting, and to obtain the best results the pulley of the engine must be in line with the pulley which is to receive the power. The distance from the line shafting to the crank shaft of the engine should be at least from six to eight times the diameter of the larger pulley.

The line shafting can be extended through the end of the building so that a blacksmith bellows, or circular cut-off and rip saw, band saw or any other wood working machinery can be driven on the outside from the same power. The illustration on the foregoing page shows an arrangement which has proven very practical. The cost of such an installation compared to the benefit derived is very slight.

Operation of Four-Cycle Engines

The operation of the large majority of internal combustion engines is based upon the same principle, termed "four-cycle." The theory was first formulated by M. Beau de Rochas in 1862 and requires four strokes of the piston, as follows: The first outward stroke draws through the intake valve a charge of the fuel automatically mixed with air in the right proportion. At the end of the stroke the valve closes and the return of the piston compresses the charge. Just before the dead center the electric ignitor is snapped which produces a spark in the cylinder, exploding the gas. The second outward movement of the piston is the power stroke, at the end of which the exhaust valve is opened. On the return of the piston the burnt gases are expelled and the cycle of operations is completed. It will be noted that one explosion is obtained for every two revolutions of the fly wheels.

Most engines of small power are of this four-cycle type. But there are many two-cycle engines also. The two-cycle engine requires only two strokes or one revolution of its fly wheel for each impulse. The incoming charge necessarily mixes somewhat with the burned gases not yet thoroughly driven out, and for this reason the two-cycle engine is neither as economical nor as reliable as the four-cycle engine. However, because of light weight and because power is applied more uniformly, the two-cycle is used extensively and to good advantage under many different conditions, particularly for boats.



The above illustrations show the four movements of the piston required to produce a power or working stroke

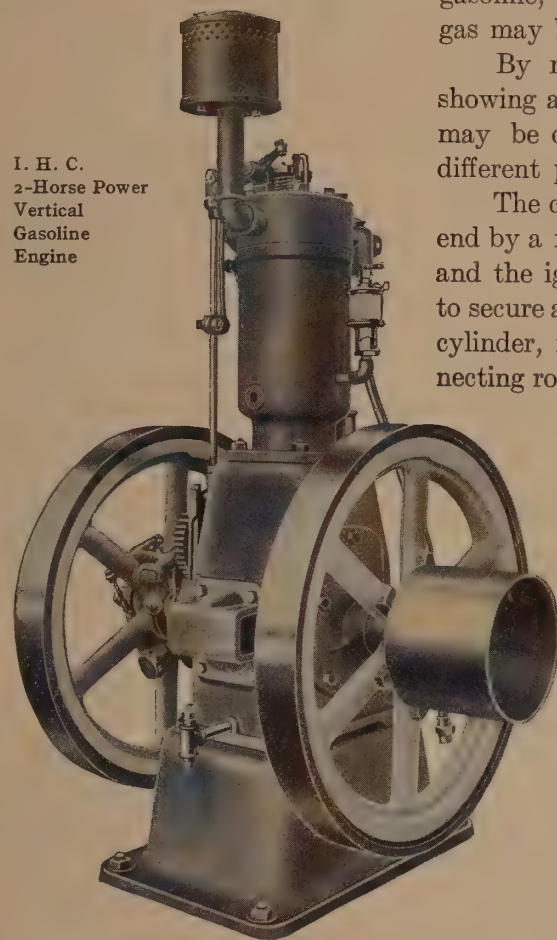
I. H. C. Vertical Gasoline Engines

2 AND 3-HORSE POWER

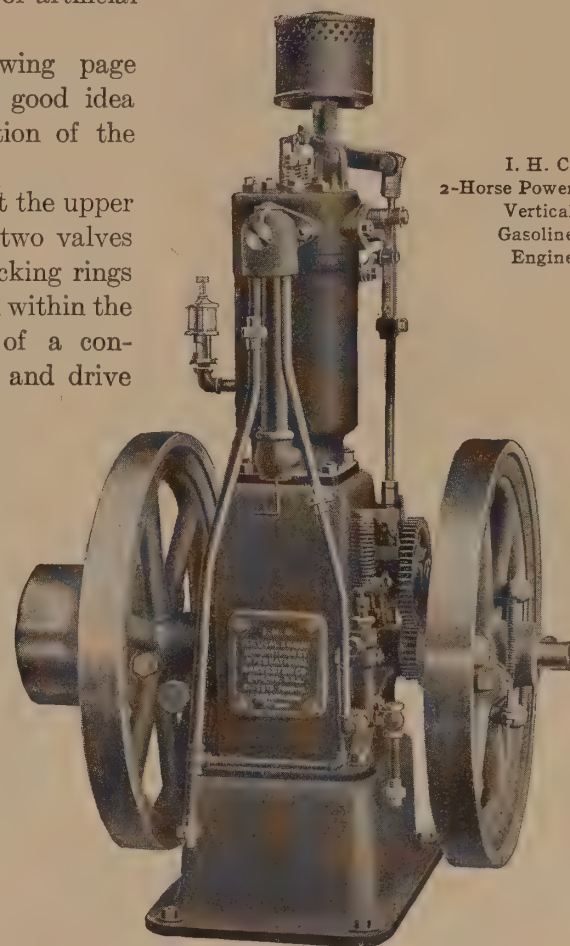
I. H. C. one-cylinder vertical gasoline engines are made in 2 and 3-horse power sizes. These engines are constructed in a thoroughly practical manner and are giving excellent satisfaction. Just as much care and attention is given to every detail of the manufacture of these engines as is given to the construction of the larger engines. These engines are regularly equipped for using gasoline, but, by slight alterations, alcohol, natural or artificial gas may be used.

By referring to the illustration on the following page showing an I. H. C. vertical engine in section, a very good idea may be obtained of its construction and the function of the different parts.

The cylinder is open at the lower end and closed at the upper end by a removable cylinder head which carries the two valves and the ignitor. The piston, which is fitted with packing rings to secure an air-tight fit and which moves up and down within the cylinder, is connected to the crank shaft by means of a connecting rod. This crank shaft carries the fly wheels and drive pulley. The air and fuel have access to the closed end of the cylinder through the inlet valve, and the burned gases have exit through the exhaust valve. The air is drawn in through the suction pipe, and the gasoline is pumped from a supply tank into the mixer, from which it is fed to the engine in quantity regulated by a needle valve. An electric spark for igniting the explosive charge is made by the ignitor. The electric current is furnished by a battery and spark coil which is part of the equipment of the engine.



I. H. C.
2-Horse Power
Vertical
Gasoline
Engine



I. H. C.
2-Horse Power
Vertical
Gasoline
Engine

CYLINDER AND HEAD

The cylinder and jacket walls are cast together with ample space between them to permit a free and easy circulation of cooling water. The cylinder head may be very easily removed from the cylinder for cleaning or any other purpose, inasmuch as the head is bolted to the cylinder instead of being cast as a part of the cylinder. It is almost impossible to remove scale from the jacket walls and around the cylinder head when the head and cylinder are cast in one piece, because there is no means of getting into the water jacket.

By removing the head from the cylinder easy access may be had to all parts of the water jacket.

PISTON

The piston is of the trunk type and amply long to provide a large wearing surface. Three piston rings, of the lap joint type and made from a special quality of gray iron, are used to prevent loss of compression past the piston. These lap joint rings prove unusually effective in retaining the compression.

The wrist pin is large so that it gives a liberal wearing surface on the connecting rod. The connecting rod is provided with a phosphor bronze bushing which is held in place by means of a set screw. A new bushing can be easily inserted should wear occur.

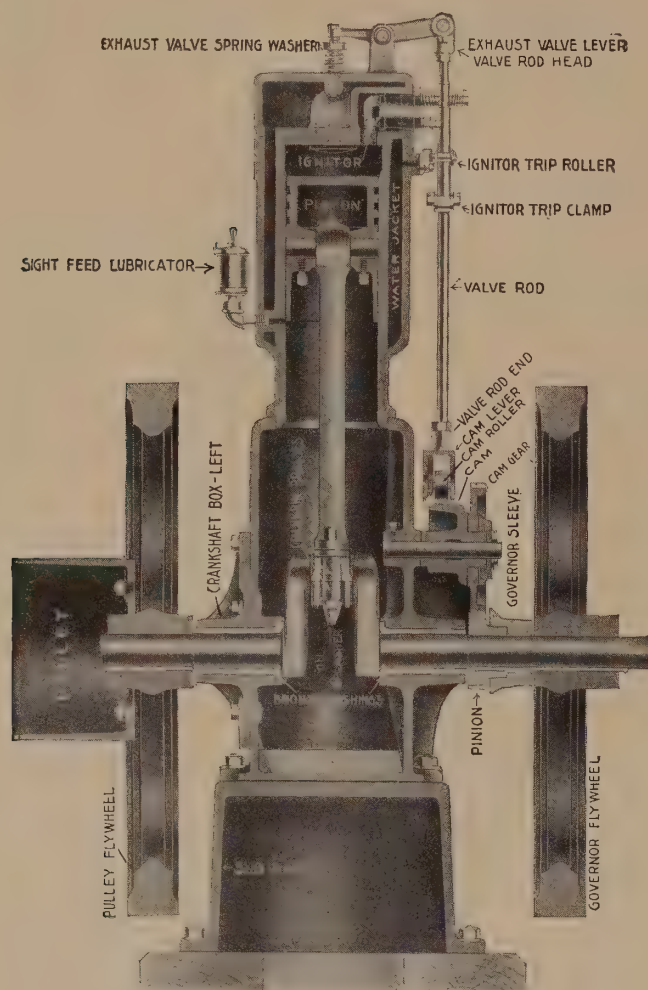
CRANK SHAFT

The crank shafts for both the 2 and 3-horse power engines are drop forged. They are large and strong and are turned accurately to size. Their liberal dimensions provide ample wearing surface in the main bearings.

BEARINGS

The main bearings are provided with phosphor bronze bushings which can be easily taken out for renewal.

The crank pin bearing is made from phosphor bronze and is bolted to the connecting rod. By removing the liners it is possible to take up from time to time any wear which might occur.



Sectional View of a Vertical Engine, Showing Working Parts

GOVERNOR

The governor is of the centrifugal hit-and-miss type. The action of the governor balls in swinging out when the engine reaches a speed above normal causes the governor sleeve to slide toward the fly wheel. From the beveled portion of this sleeve motion is imparted to the detent lever, which engages the cam lever and so holds the exhaust valve open until the speed drops to normal.

This hit-and-miss governor is very reliable, and is very sensitive in controlling the speed of the engine and consequently the fuel consumption. The low fuel consumption of this vertical engine is due in a large measure to the accuracy with which the hit-and-miss governor controls the speed of the engine.

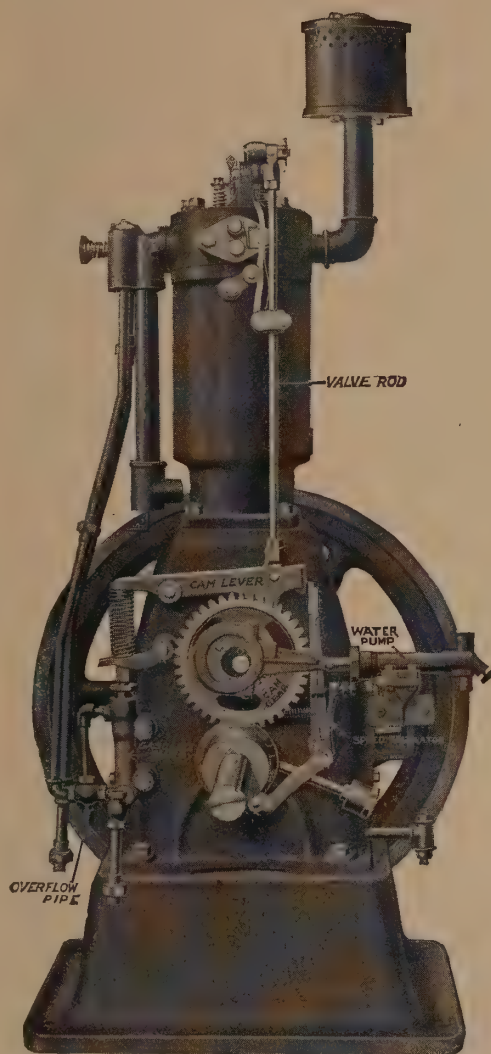
VALVE GEAR

The accompanying illustration of the engine with the fly wheel removed shows very clearly the simplicity of the valve gear arrangement. Simplicity of design in a gasoline engine is a very desirable feature. The simpler the engine the less liable it is to get out of order, the less attention it requires, the more reliable and durable it is.

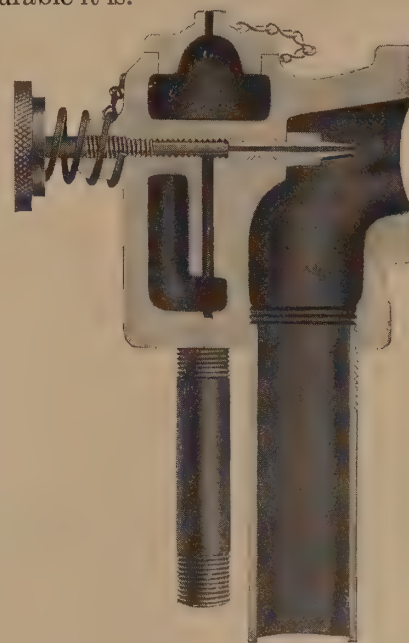
Examine the I. H. C. valve gear arrangement closely. A small pinion on the crank shaft running with the cam gear operates the valve and ignition mechanism. By the peculiar construction of the cam upon which the cam roller turns, the valve rod serves the double purpose of snapping the ignitor and opening the exhaust valve. This construction simplifies the entire valve gear arrangement.

MIXER

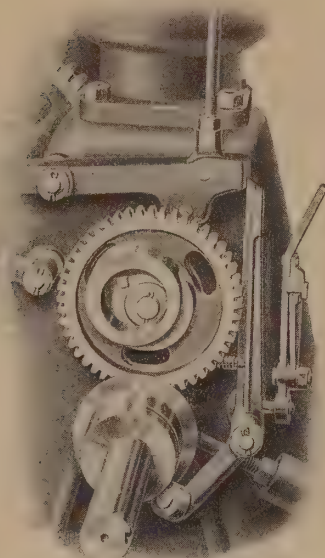
The mixer is very simple and effective in operation. A rush of air through the pipe (a) induces a flow of gasoline from the nozzle, the quantity being regulated by the needle valve. As the gasoline comes in contact with the air it is thoroughly vaporized and enters the cylinder as a homogeneous mixture. A large overflow pipe from the bottom of the mixer cup to the supply tank returns any excess of gasoline which may be pumped into the mixer. A sectional view of this mixer is shown herewith.



Side View of Vertical Engine with Fly Wheel Removed, Equipped with Circulating Pump and Speed Regulator



Sectional View of Mixer

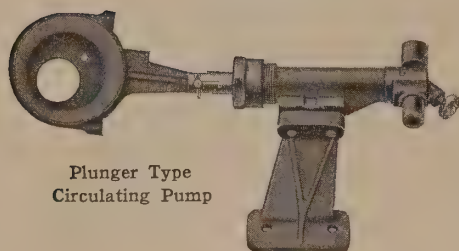


Speed Changing Device

The speed changing device illustrated is furnished on special order for the vertical engine. In order to remain within the safety speed limit of the fly wheel, it is necessary that this device be attached at the works where the proper adjustment of the governor can be made during the testing of the engine. The device cannot, therefore, be attached to engines now in the field. This device provides a variation in speed of from 310 R. P. M. to 480 R. P. M.

COOLING ARRANGEMENT

The method of cooling the I. H. C. engine includes a small cooling tank and plunger type circulating pump. This cooling arrangement is particularly desirable in localities where water is scarce or where it must be carried some distance ; also in cold climates where it is necessary to drain the engine and the tank at night in order to prevent freezing. The pump and tank may be quickly drained by means of the convenient drain cocks.

Plunger Type
Circulating Pump

GASOLINE PUMP

The plunger gasoline pump is continuous in its action. A return pipe is provided as a safeguard against leakage around the packing and consequent waste of the fuel.

LUBRICATION

An effective system of lubrication which requires minimum attention is essential to a right-working engine. Automatic oiling devices keep all main working parts on the I. H. C. engine well oiled.

A sight feed oiler on the side of the cylinder supplies oil to the piston as it passes the opening. This oil works its way into the chamber below the crank shaft where it is held so that at each revolution of the crank the oil is splashed throughout the interior by the oil splasher which dips into the oil. In this manner the piston, wrist pin, crank pin and main bearings are kept properly lubricated.

Excess oil in the bottom of this chamber may be drawn off when necessary by means of the T at the bottom.

This splash lubrication proves very desirable, especially should the operator neglect to turn on the sight feed oiler when starting the engine. In this case there is oil enough in the chamber to insure thorough oiling of all parts.

SPEED CHANGING DEVICE



Vertical Engine with Cooling Tank

Sizes and Specifications of I. H. C. Vertical Engines

H. P.	Fuel	Mounting	PULLEY		FLY WHEEL		Speed R. P. M.	Approximate Shipping Weight	Floor Space Inches	Equipment
			Diameter Inches	Face Inches	Diameter Inches	Face Inches				
2	Gasoline	Cast Iron Base	8	5	24	21½	400	875 lbs.	10½ x 24	No. 1
2	Gas		8	5	24	21½	400	840 "	10½ x 24	No. 2
2	Gas and Gasoline		8	5	24	21½	400	883 "	10½ x 24	No. 3
3	Gasoline		9	5½	26½	21½	360	1,019 "	31¾ x 26½	No. 1
3	Gas		9	5½	26½	21½	360	950 "	31¾ x 26½	No. 2
3	Gas and Gasoline		9	5½	26½	21½	360	1,027 "	31¾ x 26½	No. 3

The regular equipment of all I. H. C. vertical stationary engines includes the following accessories:

No. 1. FOR GASOLINE ENGINES. One pulley, one muffler, one galvanized steel gasoline tank with two lengths of pipe and also fittings to install the tank outside the building and connect it to the engine, one galvanized steel cooling tank with pipe and fittings and hose to connect it to the circulating pump on the engine, one electric battery and spark coil, one length of exhaust pipe, cylinder lubricator, one oil can and all necessary wrenches. An exhaust muffler is regularly furnished with this outfit, but a cast iron exhaust pot can be supplied upon special order.

No. 2. FOR GAS ENGINES. Like equipment No. 1 except that gasoline tank and fittings are omitted and gasometer added.

No. 3. FOR COMBINED GAS AND GASOLINE ENGINES. Like equipment No. 1 except gasometer added.

The I. H. C. vertical engine is constructed so as to secure the measure of safety prescribed by the rules of the National Board of Fire Underwriters.

SPECIAL SIZES OF PULLEYS FOR I. H. C. VERTICAL ENGINES WHICH WILL BE SUPPLIED UPON ORDER

DIAMETER	FACE		DIAMETER	FACE	
	2-H. P.	3-H. P.		2-H. P.	3-H. P.
3 inches	5 inches	5½ inches	10 inches	5 inches	5½ inches
4 inches	5 inches	5½ inches	12 inches	5 inches	5½ inches
5 inches	9 inches and 5 inches	5½ inches	14 inches	5 inches	5½ inches
7 inches	5 inches	5½ inches	16 inches	5 inches	5½ inches
8 inches	5 inches	7½ inches and 5½ inches	18 inches	5 inches	5½ inches
9 inches	5 inches	5½ inches	20 inches	5 inches	5½ inches

FRICTION PULLEYS

Friction clutch pulleys from 10 inches to 22 inches in diameter, inclusive, with a 4½-inch face can be furnished for 2 and 3-horse power I. H. C. vertical engines.

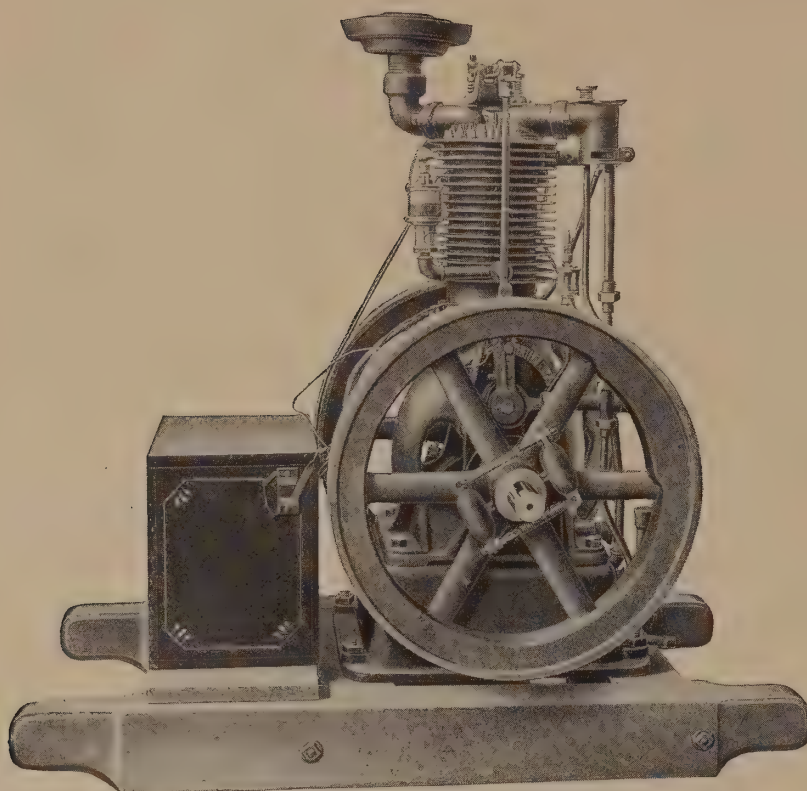
Famous Vertical Air-Cooled Engine

2-HORSE POWER

SPECIFICATIONS

The general specifications of this outfit are as follows:

Revolutions per minute, 650.	Length of skids, 38 inches.
Diameter of fly wheel, $17\frac{1}{2}$ inches.	Width of skids, $18\frac{1}{4}$ inches.
Face of fly wheel, $2\frac{1}{8}$ inches.	Weight of outfit complete, 327 pounds.
Capacity of gasoline tank, $1\frac{3}{4}$ gallons.	Height of outfit, 34 inches.



2-Horse Power Famous Air-Cooled Engine

A special plunger is furnished for pumping gasoline into the cup before starting. The gasoline supply tank is located in the sub-base so that the engine mounted on skids is a self-contained outfit. The battery box is fastened to the skids in front of the engine.

A pulley ring 5 inches in diameter with a 5-inch face is furnished regularly, but all regular and special friction clutch and plain pulleys for the 2-horse power engine listed on page 17, except the 18, 20 and 22-inch pulleys, can be furnished for this engine.

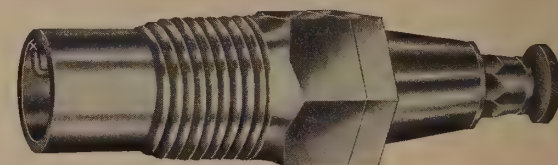
Many purchasers of a gasoline engine desire an air-cooled engine because a water tank and cooling water are not required. On the Famous air-cooled engine, high temperatures of the cylinder which would interfere with the working of the engine are prevented by currents of cooling air. It will be noted from the illustration that the cylinder is cast with ribs or spines to give a large radiating surface. The fan, driven by a belt around the fly wheel, quickly drives away all the heat radiated by the ribs and thus keeps the cylinder at the proper working temperature.

This engine is equipped with the fly wheel type of governor.

Proper lubrication is insured by automatic devices. The main bearings and the piston have sight feed oilers, and the crank piston bearing is provided with a splash system of lubrication. Although the crank case is not entirely closed, yet it is so designed that no oil can be thrown out.

Jump spark ignition is used, the current for which is furnished by five dry cells and a spark coil.

The gasoline pump is positive driven by means of an eccentric.



Spark Plug

I. H. C. Two-Cylinder Vertical Engine

25-HORSE POWER

This two-cylinder, 25-horse power engine has been especially designed to supply power for municipal or private electric lighting plants and water works, for factories, and for all purposes where close regulation of the speed is essential. The variation in speed on this engine from no load to full load is less than 2 per cent, so that the engine can be either belted or direct connected to generators. This regulation is as close as that of a high grade steam engine.

The engine can be equipped for the use of either city, natural or producer gas, or gasoline for fuel. It is necessary only to change the piston and the mixing valves. The engine base is cast in one piece, then accurately machined to receive the bearings. Four large openings in the crank case give access to the internal parts.

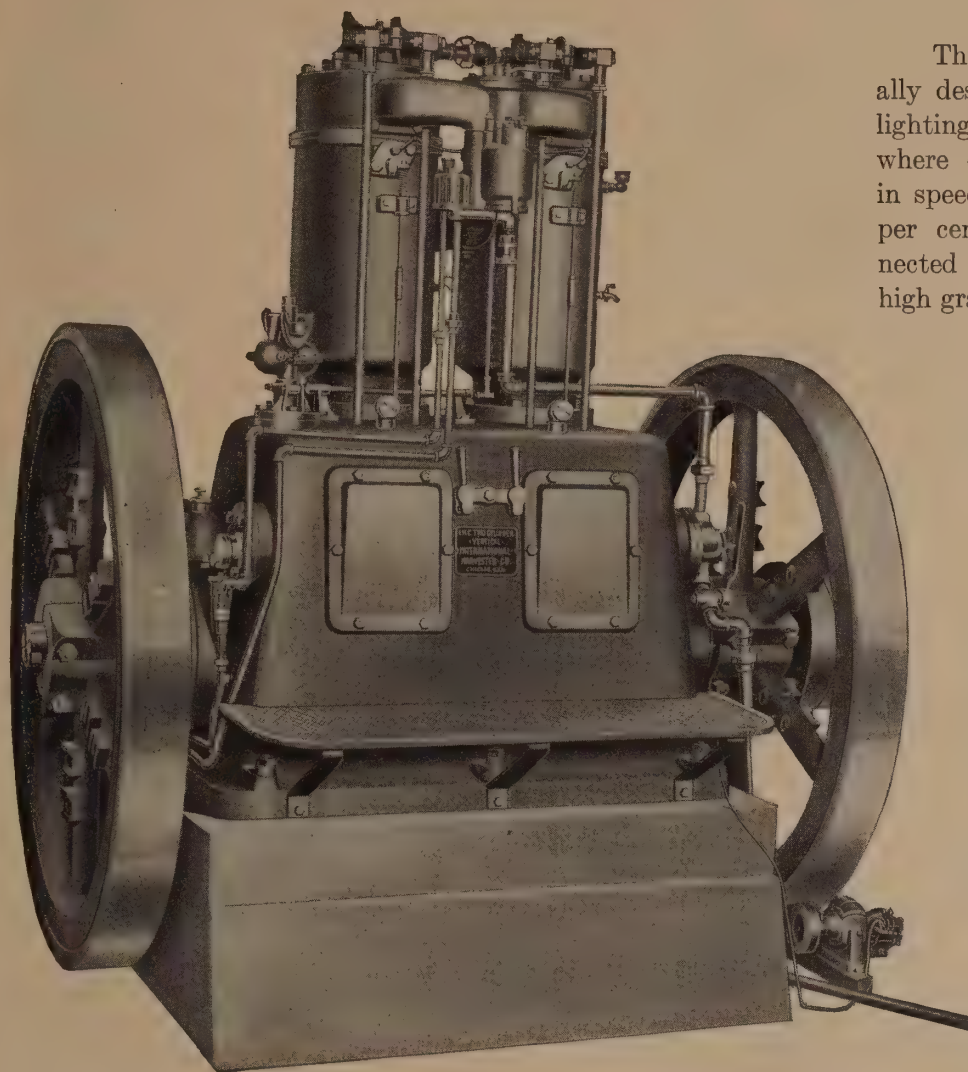
CYLINDERS

The cylinders and all cylinder parts are interchangeable, thus rights and lefts are avoided. The cylinders are kept at the proper temperature by a good circulation of cooling water. These cylinders are cast from a special close-grained iron and are securely bolted to the engine base so that they can never get out of line.

The cylinder head is cast separately instead of being part of the cylinder. The water jackets of the cylinder head and cylinder register.

PISTONS

The pistons have four packing rings and a beveled oil wiper ring which is designed to avoid the pumping of oil. A high oil lever may be maintained in the base without liability of trouble due to an excess of oil fouling the ignitor or valves in the combustion chamber.



Front View Two-Cylinder, 25-Horse Power Engine
Equipped with Gasoline Mixer

CONNECTING RODS

The connecting rods are drop-forged steel of the marine type at the crank end, and a solid end wedge take-up at the piston end. At the crank end, the bolts are such that the upper half of the crank pin bearings are held firmly to the connecting rod regardless of the wear of the bearings. This design eliminates any liability of the connecting rod becoming free and thus damaging the engine. These bearings are of the best phosphor bronze.

MAIN CRANK BEARINGS

The crank bearings are cast separately and are set in the base with tongue and groove so that there is no chance for them to get out of alignment, either when they are on the engine or in replacing them after having been taken out. These bearings are made from the best babbitt metal which is practically impervious to wear.

VALVES

Each valve is mounted in a separate cage placed in the cylinder head. This construction is of special advantage because the valves can be removed for re-grinding by loosening only two bolts without disturbing the cylinder head or breaking the water joint.

The valves are of the poppet type—one inlet and one exhaust valve.

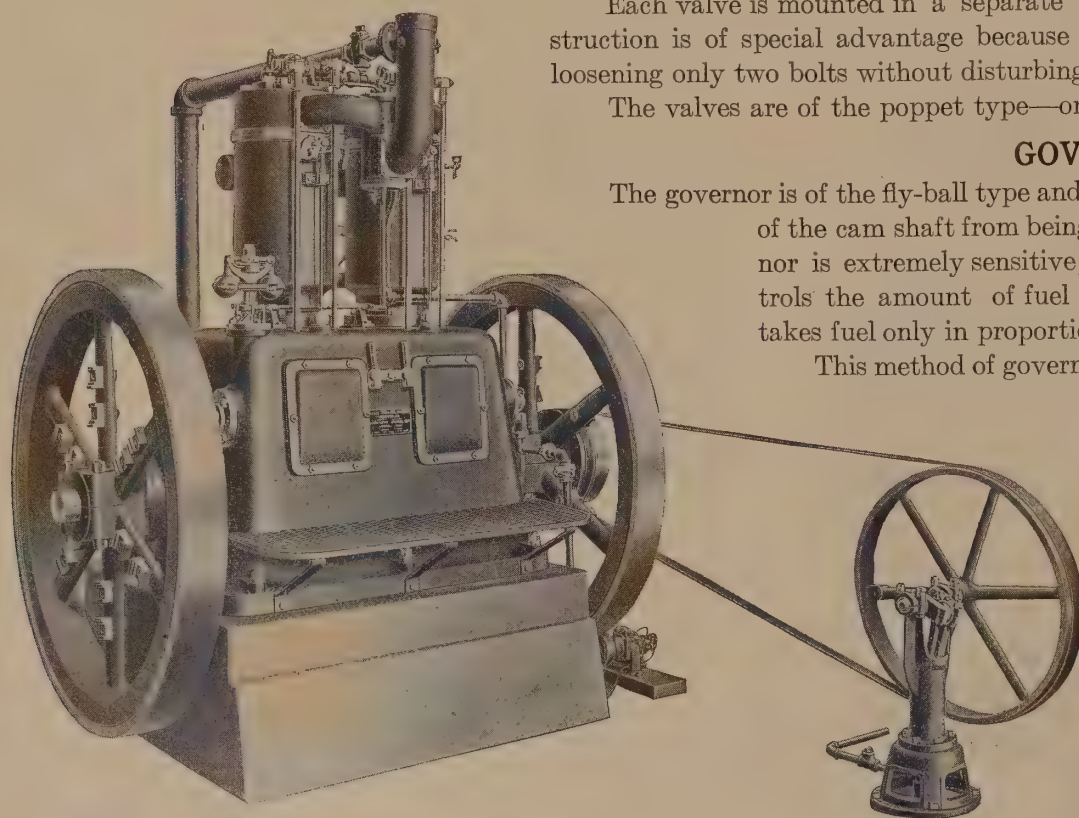
GOVERNOR

The governor is of the fly-ball type and is spring driven, which prevents the variation of the cam shaft from being transmitted directly to the balls. This governor is extremely sensitive, and it operates the throttle valve which controls the amount of fuel admitted into the cylinder, thus the cylinder takes fuel only in proportion to its load—the lighter the load the less fuel.

This method of governing on a two-cylinder engine insures an impulse at every revolution.

IGNITION

The ignition system is of the make-and-brake type and accomplished either by batteries or an auto-sparker. The movable electrode in the ignitor is provided with an outer bearing support, which prevents wearing of the electrode shaft and causing a cylinder leak. The length of contact and time of ignition are controlled from the outside—a very convenient arrangement for controlling ignition and one which may be adjusted while the engine is in operation.



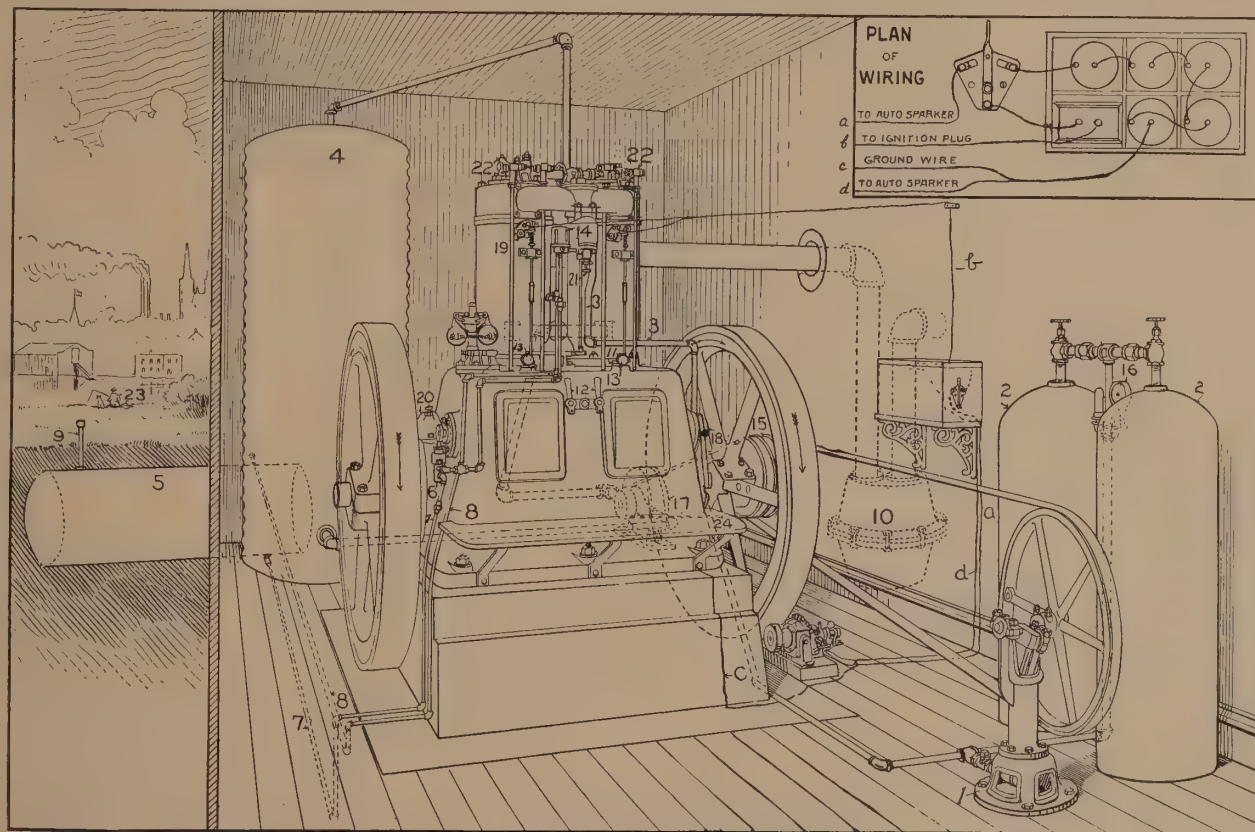
Two-Cylinder Engine Equipped for Producer Gas and Air Starting Arrangement

MIXER

The mixer is of the throttling type, but so designed that it cannot possibly stick or gum up from dirt or tar in the fuel, and it cannot flood.

RELIEF CAM AND STARTING DEVICE

The relief cam, operated from the outside, provides compression relief for starting. A starting device is furnished which consists of a small air compressor, two tanks and a starting valve mechanism on the cam shaft of the engine. The valve handle at the inlet yoke and a lever at the center of the engine base throw a supplementary cam into action, which permits the operation of one cylinder as a compressed air engine. This valve at the inlet yoke throws out gas connection with this cylinder and admits the compressed air, but in no way does it interfere with the regular working of the other cylinder. The engine now starts as a single-acting, compressed air engine. When the other cylinder takes a few explosions the air is turned off, the cam levers and valve on the inlet yoke are moved to their original positions, and both cylinders are in normal operation under gas.



Method of Installing 25-Horse Power Engine

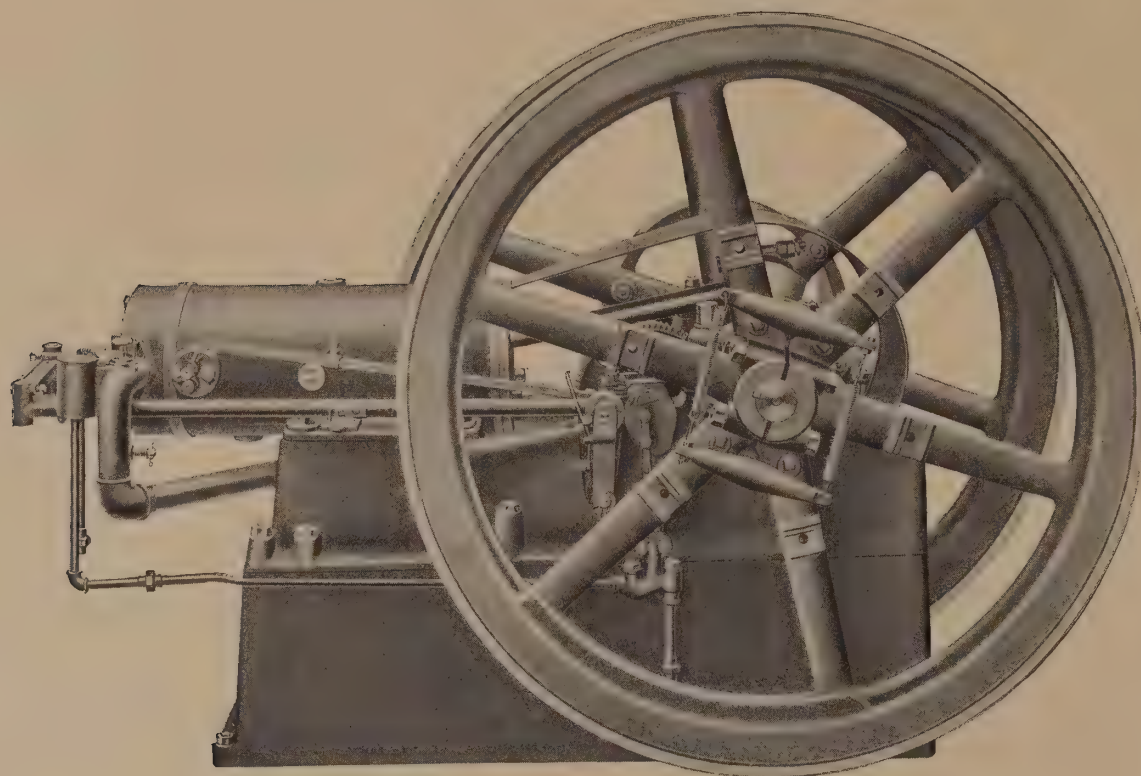
WEIGHT

The net weight of the engine is 6,500 pounds.

1. Air Compressor
2. Air Tank
3. Air Pipe
4. Water Tank
5. Gasoline Tank
6. Gasoline Pump
7. Gasoline Suction Pipe
8. Gasoline Overflow Pipe
9. Gasoline Vent Pipe
10. Muffler Pot
11. Ignitor Adjusting Rod
12. Cam Shifting Levers
13. Ignitor Adjusting Handle
14. Gasoline Cup
15. Double Pulley
16. Pressure Gauge, No. 180
17. Water Circulating Pump
18. Double Cam
19. Ignitor Bodies
20. Vent Valve
21. Gasoline Needle Valve
22. Valve Levers
23. Engineer
24. Compressed Air Cock

I. H. C. Horizontal Gasoline Engines

4, 6, 8, 10, 12, 15 AND 20-HORSE POWER



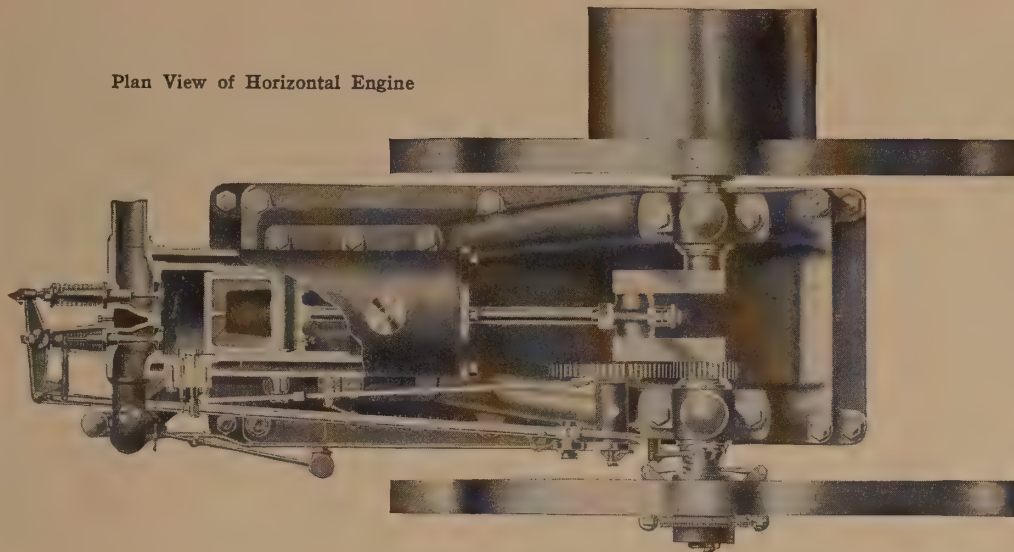
Working Side of I. H. C. Horizontal Engine

The I. H. C. horizontal engine is especially designed for general farm work—threshing, pumping, sawing, cutting feed, etc.; for use in grain elevators, grist and feed mills, hoisting plants; for pumping stations and irrigating; for shop use and all other ordinary power purposes to which an engine of its size is adapted.

This engine can be used anywhere in the city or in the country. It is equipped with electric ignition so that it is never necessary to have an open flame near the engine, which would prevent its use in insured buildings.

As regularly furnished, this horizontal engine is equipped for using gasoline. By slight alterations however, natural or artificial gas, alcohol or kerosene may be used as fuel.

Plan View of Horizontal Engine



the jacket walls when necessary. The jacket walls allow ample space for a free circulation of the cooling water. The crank end of the cylinder is closed with a water ring, and the other end is closed by the cylinder head. The cylinder and head are both cast from a special quality of close grained iron. Four or six large studs, depending upon the size of the engine, are used to bolt the cylinder base firmly to the engine base.

COMPRESSION

The cylinder is specially designed to insure high compression of the explosive charge, which gives the engine remarkable efficiency. The valves are well seated and the piston rings are correctly designed, so that there is no loss of compression and hence no loss of power.

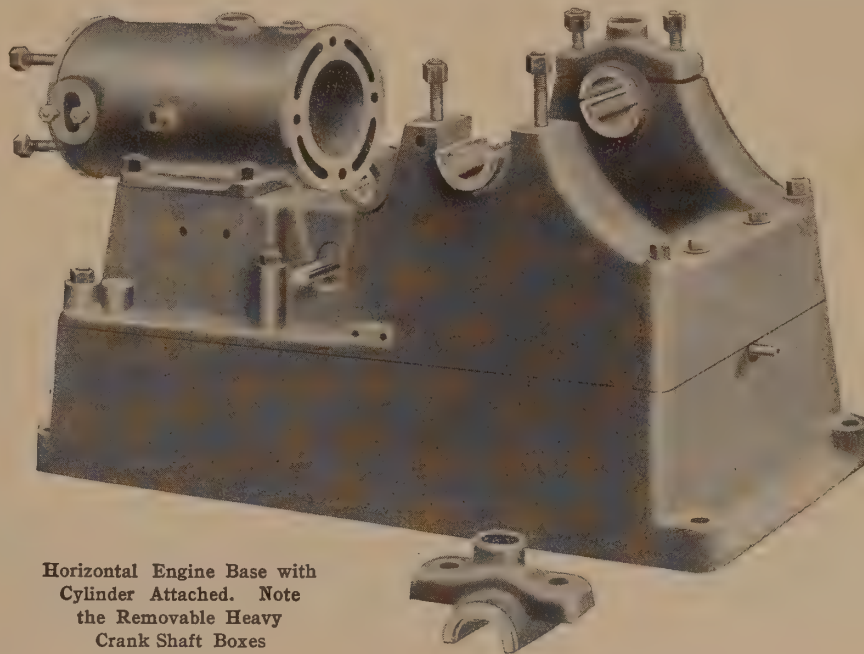
ENGINE BASE

This base is cast in two parts, which are firmly bolted together. It is neat in design and appearance, yet possesses ample strength and rigidity to hold all mechanism in perfect alignment. An illustration of this base will be found at the bottom of the page.

CYLINDER

The illustration above shows a plan view of the horizontal engine complete with the cylinder head and piston cut away. On the following page is shown a sectional view of the cylinder and head only.

The cylinder and jacket walls are cast in one piece with both ends open so that it is easy to clean



Horizontal Engine Base with
Cylinder Attached. Note
the Removable Heavy
Crank Shaft Boxes

CYLINDER HEAD

This part is bolted to the cylinder and the joints are made tight with an asbestos gasket. The water jackets of the two parts register, which enables the cooling water to flow from the cylinder around the valve seats and the parts in the head. This is very desirable in the case of the exhaust valve. Exhaust gases are extremely hot in leaving the cylinder and it is necessary that the valve and seat be cooled as much as possible to prevent deterioration.

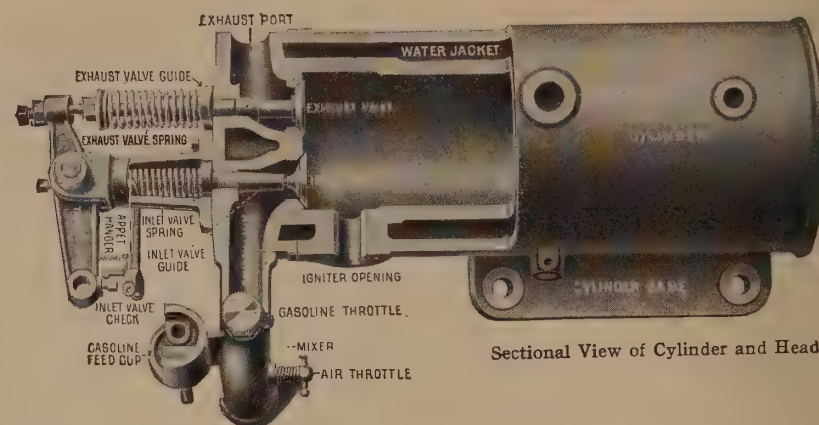
The intake and exhaust valves are of the poppet type, are ground in their seats and are held by their respective springs. The exhaust valve has a cast iron head and steel stem, this construction having been found to be the most durable. The seat is removable, which is a very desirable feature, for, should the seat be pitted by the hot gas an entirely new cylinder head would not be required.

The intake valve is all steel. Both valves are sufficiently large to permit the ready ingress and egress of the gases at a rapid rate.

Long valve guides are provided, distributing the wear over a large part of the stem and insuring the proper seating of the valves.

The tappet hanger sets over the intake valve and forms the pivot for the tappet arm, which opens the exhaust valve. Adjustment is made by means of the set screw and lock nut on the end of the tappet arm.

The inlet valve check is one of the interesting features of the I. H. C. engine and contributes much to its economy. When a speed above normal is attained and the exhaust valve is held open continuously for a time, as will be hereafter explained, this check automatically keeps the intake valve closed. No fuel is admitted to the cylinder and wasted. Letters patent have been granted to the International Harvester Company on this very novel, effective arrangement.



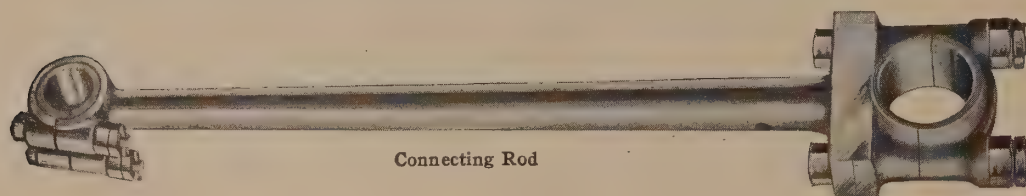
Sectional View of Cylinder and Head

CONNECTING ROD

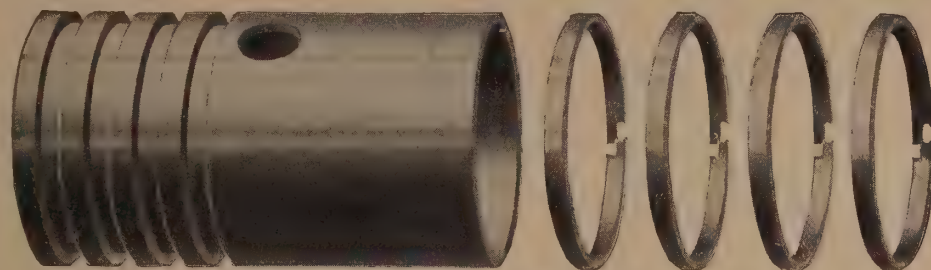
The connecting rod, here illustrated, is made from a drop forging which is carefully machined and polished. The bearing for the wrist pin is provided with a split phosphor bronze bushing, the parts of which are adjustable by means of bolts in the head. Thus any wear that may occur can be quickly taken up.

On the crank end a divided box is used which is securely bolted to the connecting rod. Both parts of this box are made from phosphor bronze. This box is likewise adjustable.

Should it ever be necessary to renew the box complete, the old one can be detached from the connecting rod without removing the piston or wrist pin.



Connecting Rod



Piston and Lap Joint Piston Rings

PISTON

The piston of a gasoline engine should fit perfectly so that there is no loss of compression, which would decrease the power. The piston on the I. H. C. horizontal engine is of the trunk type and of good length to provide ample wearing surface on the cylinder. Iron of the best quality is used in casting the piston. It is turned and faced and then cross-bored for the piston pin. The piston is then drilled in a jig, after which it is ground to fit the

cylinder. The maximum variation in grinding is .0002 of an inch, so that absolute accuracy is always insured.

The piston rings are of the lap joint type and are ground to an exact diameter. This style of joint has been proved to be the best to maintain the compression without leak past the piston.

The wrist pin is unusually large which gives a long and large wearing surface. This pin is manufactured from a special grade of machine steel, carefully hardened and ground to an exact size. It is never necessary to run the engine any length of time with a dry pin because the supplementary wrist pin oiler oils the pin immediately, which greatly reduces the wear. The wrist pin is held in place without turning or end movement by two set screws with lock nuts.

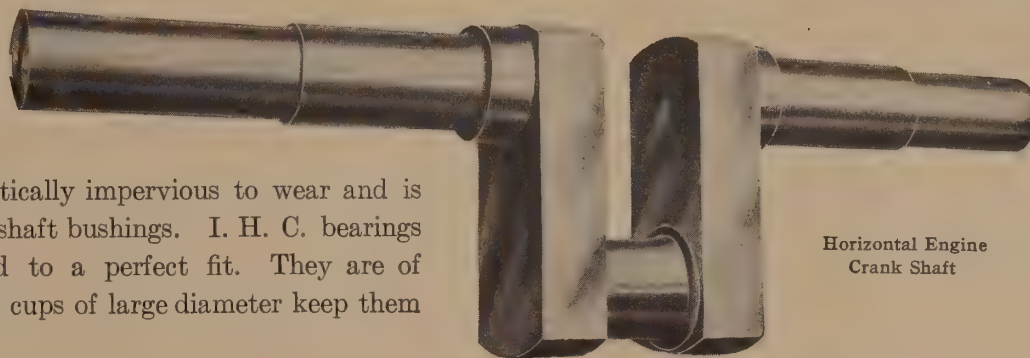
CRANK SHAFT

The smaller size crank shafts are drop forged; the larger sizes are forged from solid, open-hearth steel billets without welds of any kind. They are carefully centered and turned to size,—the maximum variation being .0015 of an inch. This makes them interchangeable. The proportions are liberal and according to the strains under which the parts must work. The crank pin is of large diameter which gives ample wearing surface.

Every crank shaft is rigidly inspected and tested before being placed on the engine. This is advisable, inasmuch as the crank shaft receives the full force of the explosion as well as the strain of the driving pulley, and also carries the weight of the fly wheels.

CRANK SHAFT BEARINGS

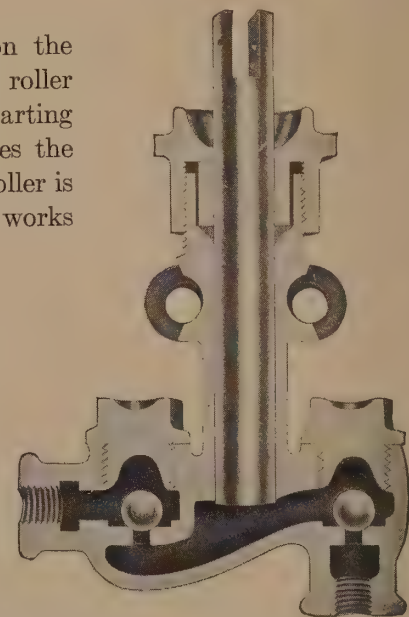
Phosphor bronze, the material of which crank shaft bearings are made, is the hardest known alloy for this purpose. Phosphor is practically impervious to wear and is so tough that it is admirably adapted for crank shaft bushings. I. H. C. bearings are machine finished to gauge and hand scraped to a perfect fit. They are of liberal length and thickness and extra heavy. Oil cups of large diameter keep them properly lubricated.

Horizontal Engine
Crank Shaft

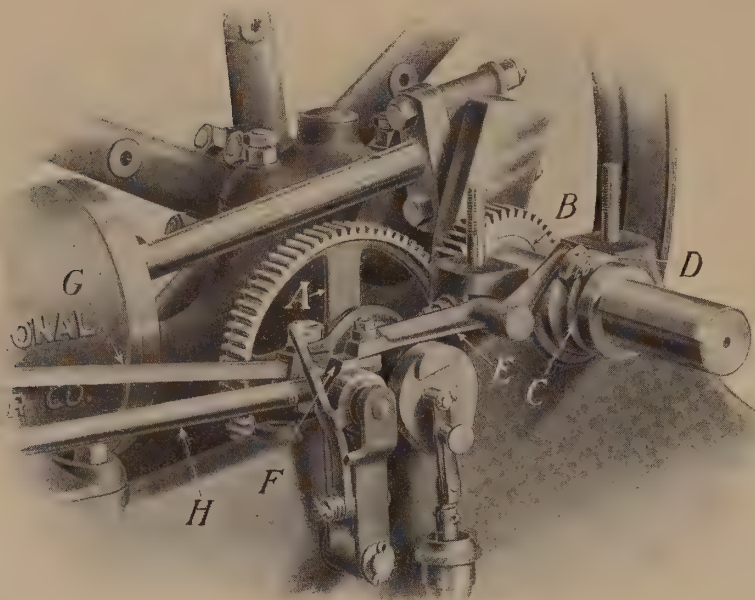
VALVE MECHANISM

The hit-and-miss style of governing an I. H. C. engine is not only very sensitive in its regulation, but reduces the fuel consumption to a minimum. When above speed the arm from the governor balls pulls the sleeve "C" outward, as shown in the illustration. The beveled portion presses upward on the roller "D," causing the detent arm "E" to move downward. When the long side of the exhaust cam presses the roller at the end of rod "H" outward, the lever "E" engages a notch at "F" holding the exhaust valve open until the speed is reduced to normal. The sleeve "C" moving back allows the detent lever to disengage "F," and the cycle of operation is again taken up. The spur pinion "B" on the crank shaft engages with "A," a spur gear of twice its diameter, thus reducing the speed of the exhaust cam, so that the exhaust valve is open every other revolution. Likewise, the ignitor is snapped by the rod "G" by the movement of the eccentric on the half speed shaft.

The small auxiliary cam on the exhaust cam is made to engage the roller and relieve the compression when starting the engine. This feature eliminates the drudgery of starting. When the roller is thrown back into place the engine works under full compression.



Sectional View of the Gasoline Pump, Showing Plunger and Ball Valves



Detail View of Horizontal Engine with Fly Wheel Removed to Show Gears, Governor and Valve Mechanism

GASOLINE PUMP

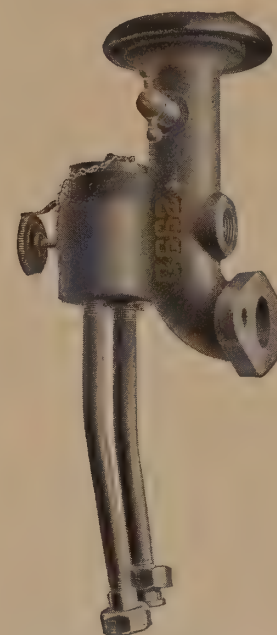
All I. H. C. gasoline engines are fitted with a plunger type gasoline pump. A very novel and effective valve arrangement is used. The upward movement of the plunger draws gasoline through the ball valve to the right while the other one remains seated and thus prevents suction from that direction. A downward movement of the plunger forces the gasoline out to the left and up to the mixer cup. The escape of gasoline past the plunger is prevented by a packing gland of accepted construction.

All parts of the pump are brass with the exception of the plunger and balls, which are steel.

Alcohol Attachments for I. H. C. Engines



Alcohol Mixer Attached to the Cylinder of the Horizontal Engine



Alcohol Mixer for Vertical Engines

HORIZONTAL ENGINES

On this page is shown an illustration of the alcohol attachment which can be furnished for the horizontal stationary engine.

This attachment for the horizontal engine consists of a new cylinder head complete, an alcohol mixer and filter. It is necessary to furnish this new cylinder head complete in order to provide greater compression in the cylinder, for it is only possible to obtain the rated horse power economically when using alcohol by supplying greater compression.

This alcohol attachment is furnished as an extra only on special orders and will not be furnished for engines now in the field, inasmuch as it is necessary to use with this attachment the wire gauze cooling tank and plunger type circulating pump. This cooling arrangement is furnished with the alcohol attachment in order to insure maximum efficiency.

VERTICAL ENGINES

Above is also shown an illustration of the alcohol attachment which can be furnished for 2 and 3-horse power vertical engines. This attachment operates in all respects similar to the attachment for the horizontal engines described above. It likewise cannot be furnished for engines now in the field.

The special cooling arrangement which must be used with this attachment is described and illustrated on page 28.

Kerosene Attachment for I. H. C. Horizontal Engines

The engine here illustrated is like the regular I. H. C. gasoline engine described on pages 22 to 29 inclusive, except that it has instead of the regular gasoline mixer an attachment for using kerosene as fuel.

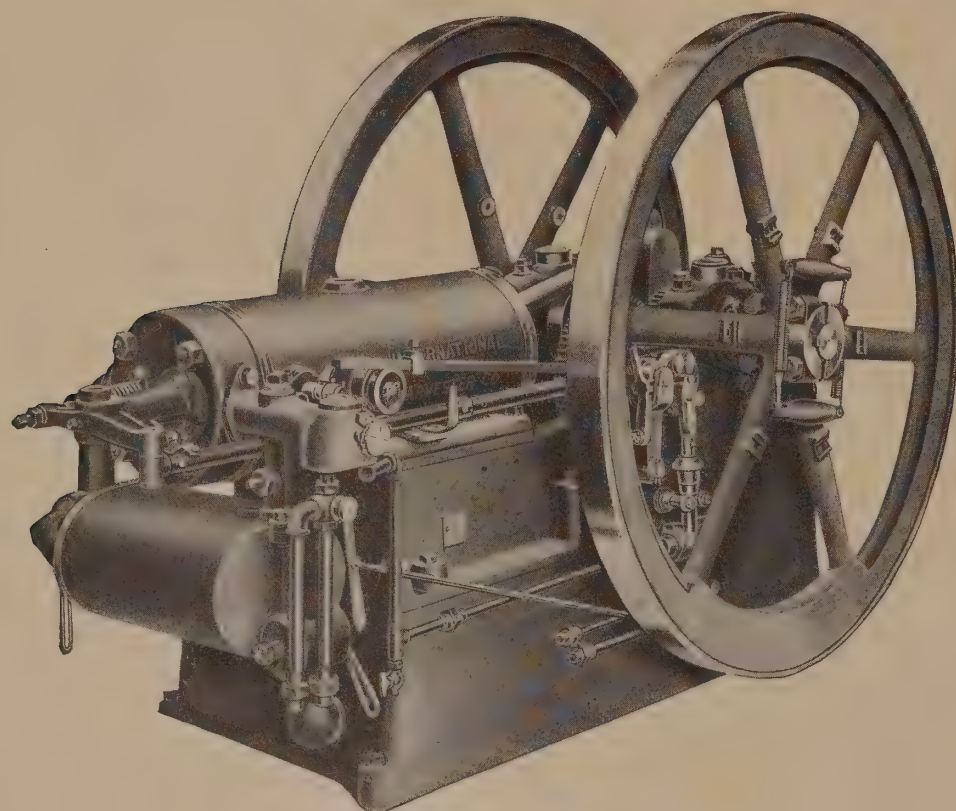
This attachment consists of a mixer and a heater, which lies under the cylinder head, into which, by means of a valve, any proportion of the hot exhaust gases may be turned. By means of a similar valve on the mixer side any amount of fresh air may be drawn through the heater, thus regulating the temperature of the incoming charge. A small amount of exhaust gas is admitted to the mixer adjacent to the needle valve and becomes a part of the explosive mixture. The purpose of re-admitting this exhaust is to overcome premature explosions. It is also an aid in running the engine under no load, as it assists in vaporizing the kerosene. Two fuel tanks and the necessary piping are used.

STARTING

The engine is started in the usual manner, using gasoline as a fuel, and as soon as the engine has warmed up sufficiently the fuel is changed from gasoline to kerosene by throwing the lever of a three-way cock. The length of time that the engine should run on gasoline depends on the temperature of the surrounding air. In an ordinary room from 3 to 5 minutes are required. It is unnecessary to use the heater unless the temperature is freezing or when working under light loads.

The fuel consumption is the same as gasoline consumption and depends upon the setting of the fuel valve. The engine will run under no load, using kerosene, but if it is required to run this way for more than an hour or so at a time it would be cheaper to use gasoline, which can be done by a simple turn of the three-way cock.

This kerosene attachment may be attached to any of the regular I. H. C. horizontal or Famous horizontal engines. The attachment, however, must be put on at the works so that the engine is in reality shipped out as an I. H. C. kerosene or a Famous kerosene engine.



I. H. C. Horizontal Engine with Kerosene Attachment

The Use of Kerosene in I. H. C. and Famous Gasoline Engines

In cases where an I. H. C. or Famous gasoline engine is working under a constant load of one-half its rated horse power or more, it will be found economical to operate the engine on a mixture of kerosene and gasoline. This should be mixed in the proportion of one part of gasoline to four or five parts of kerosene. Some have found that by using kerosene it is possible to reduce the cost of running from 20 per cent to $33\frac{1}{3}$ per cent. With an engine of large horse power, under continuous operation, this reduction in fuel bills will mean a considerable saving in the course of a year.

SUPPLY TANKS

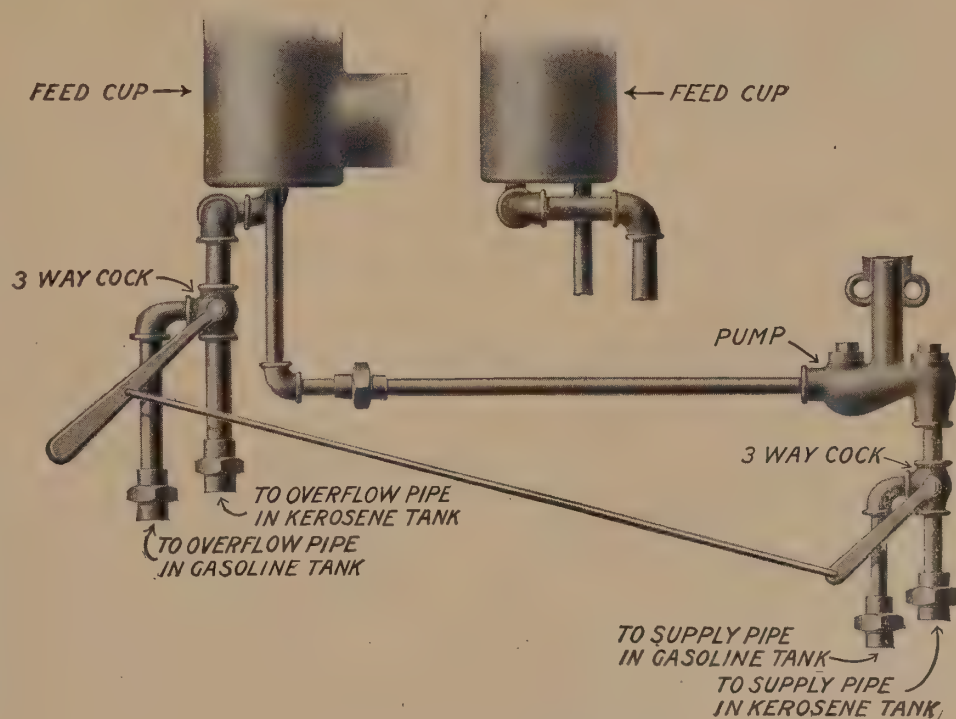
To use a kerosene mixture properly, it is necessary to have two tanks—one for straight gasoline, and another for the mixture of gasoline and kerosene, in proportions of one to four or five. These tanks are both piped to the engine pump, as shown in the illustration, and are shut off by means of a three-way cock. Two overflow pipes from the feed cup, also operated by a three-way cock, carry the overflow of kerosene mixture and of gasoline back to the supply tanks. No change in the engine itself is necessary.

STARTING THE ENGINE

To start the engine, throw the three-way cock so that the supply of gasoline is turned on and the supply of kerosene mixture shut off. This will permit a supply of gasoline to be pumped into the feed cup. Start the engine as ordinarily on straight gasoline, and let it run for about one-half hour, so that the engine is well warmed up, then shut off the gasoline and turn on the kerosene mixture.

STOPPING THE ENGINE

At the end of the run, shut off the kerosene mixture, turn on the gasoline, and allow the engine to run for five or ten minutes before closing down. In this way all the kerosene mixture is cleaned out of the feed cup and pipes, so that when the engine is finally stopped it contains nothing but gasoline. The engine is thus in shape to start up the next time without delay.

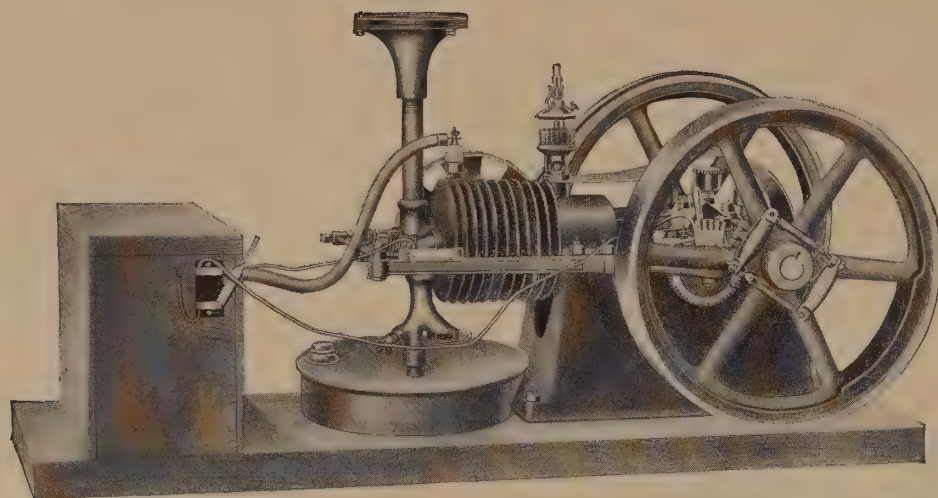


Plan of Piping for Kerosene Mixture

Tom Thumb Famous Air-Cooled Gasoline Engine

SPECIFICATIONS:

Speed—600 revolutions per minute.
Size pulley—4-inch diameter, 2½-inch face.
Weight complete—193 lbs.
Size base—12-inch x 42-inch.
Fly wheel—15½-inch diameter, 2¼-inch face.



Tom Thumb Famous 1-Horse Power Engine

This little air-cooled engine has proved very popular for all small work on the farm and in the shop. It is so light in weight that it can be easily transported from place to place to operate the cream separator, pump, fanning mill and many other machines which do not require over one horse power.

As will be seen a heavy, bothersome water tank is not necessary. A small fan on the pulley side driven by a round belt from the fly wheel prevents the cylinder from overheating. The engine will develop the full

rated horse power all day without overheating, which cannot be said of many other air-cooled engines.

A simple mixer over the gasoline tank makes a gasoline pump unnecessary. The suction stroke of the piston produces a partial vacuum in the pipe which induces a flow of gasoline into the mixer, the quantity of which is regulated by a needle valve. As the air rushes into the mixer, it vaporizes the fuel and thus supplies the cylinder with the proper proportioned mixture. The valve mechanism is very simple—by the removal of one bolt screwing into the head of the cylinder both valves can be taken off. The governor is of the hit-and-miss type, sensitive in its action. Jump spark ignition is used. The spark plug is found on top of the cylinder in a convenient and accessible place. Five cells of dry batteries and a spark coil are furnished with the engine.

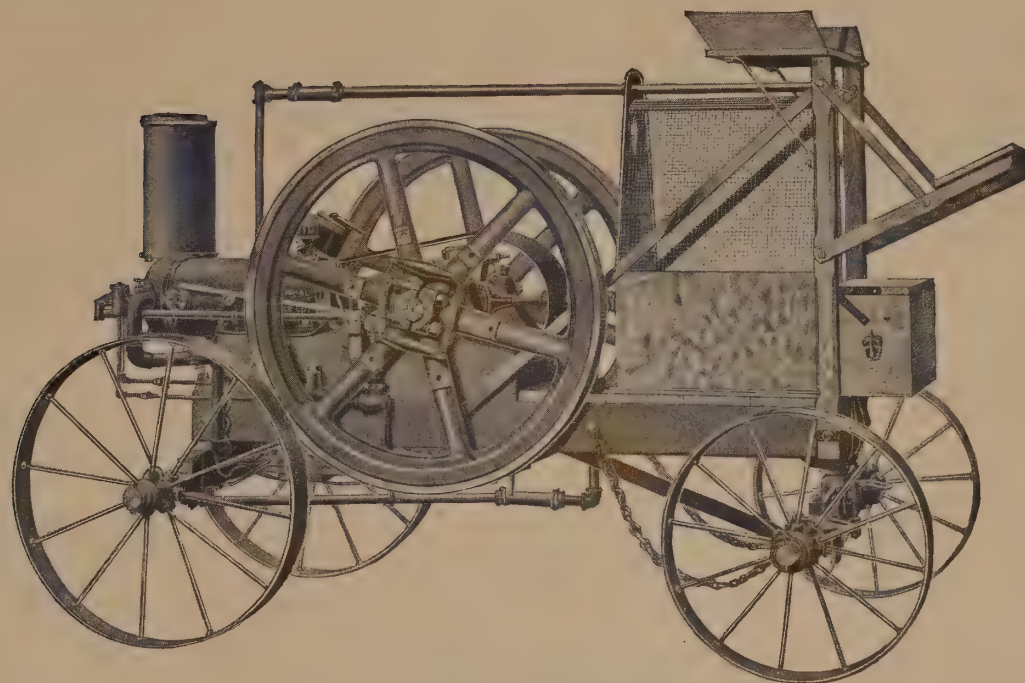
A 6-inch plain pulley, 2½-inch face, is furnished regularly with this engine. A special 6-inch pulley with 5-inch face is furnished on order which can be used for driving the Standard and the walking beam pumping jacks. A 4-inch pulley may be had on special order.

PULLEY ATTACHMENT

A pulley attachment complete for driving the Cream Harvester is furnished regularly. This attachment consists of a reducing gear and a 4-inch plain pulley with a 2-inch face which is capable of transmitting ½-horse power. It drives the Cream Harvester at the correct speed.

International Harvester Company Portable Gasoline Engines

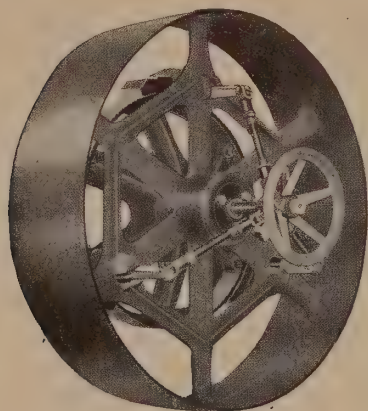
4, 6, 8, 10, 12, 15 and 20-HORSE POWER



Working Side of Portable Engine

International Harvester Company portable engines have been designed to supply the demand for a reliable engine that could be easily transported from place to place. For running huskers and shredders, threshers, shellers, for pumping and other farm purposes, these engines are unexcelled. They are also ideal contractors' outfits for well drilling and stone crushing, pumping water out of sewers and lowlands, for operating temporary electric lighting plants, etc. The engine proper is in all respects similar to the I. H. C. horizontal engine described on pages 22 to 29 inclusive, except that it is mounted on trucks for convenience in transporting.

The trucks are light yet very strong, and are rigid enough to withstand any jarring or jolting encountered in traveling over rough roads or uneven fields. With the exception of the hubs which are cast, the wheels are constructed of steel. Each axle is a solid piece of steel, turned down at the ends to form a bearing for the wheel. The frame which supports the engine is substantially constructed and will stand up under all conditions.



Friction Clutch Pulley

two drain cocks, through which the water can be drained off to prevent freezing.

IGNITION

Electric ignition is used. Besides the regular equipment of batteries an auto-sparker is furnished, which is driven by the fly wheel of the engine. By this means it is possible to start the engine with the batteries and then switch to the auto-sparker.

Hot tube ignition can also be furnished when specially ordered. This method necessitates a small gasoline supply tank, burner and hot tube.

FUEL CONSUMPTION

Owing to the practical design of this engine and the high compression to which the charge in the cylinder is subjected, the fuel consumption is very low. About one gallon of gasoline per horse power is all the fuel required for a ten hour run. A 10-horse power engine doing full ten-horse work for ten hours would consume about ten gallons of gasoline.



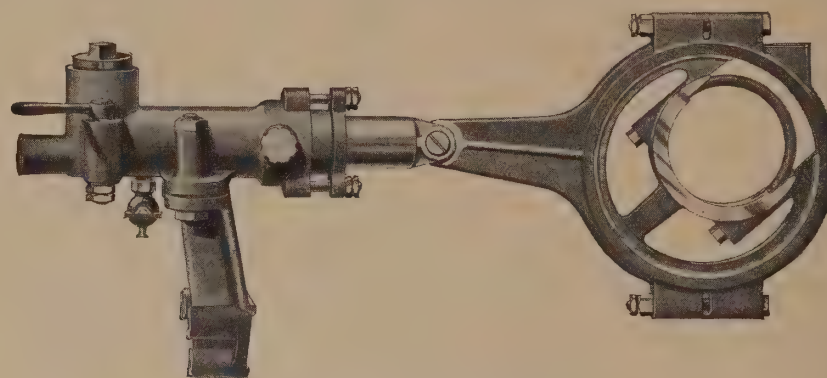
Speed Changing Device for Stationary and Portable Horizontal Engines

COOLING TANK AND PUMP

The cooling arrangement on the International Harvester Company portable engine proves very desirable in cold climates where it is necessary to drain the tank to prevent freezing, and in dry climates where water is not easily obtained or must be carried some distance.

The cooling tank is small, holding but a few gallons of water, and this is pumped through the engine jacket by means of a circulating pump, and then cooled by being distributed over the screen. This cooling arrangement effects a great saving in weight over the large, clumsy arrangements ordinarily used. Owing to the small quantity of water required, the tank may be very quickly drained in cold weather to prevent freezing, and refilled without inconvenience at the beginning of another run.

The circulating pump is of the plunger type and has



Plunger Type Circulating Pump

PULLEY

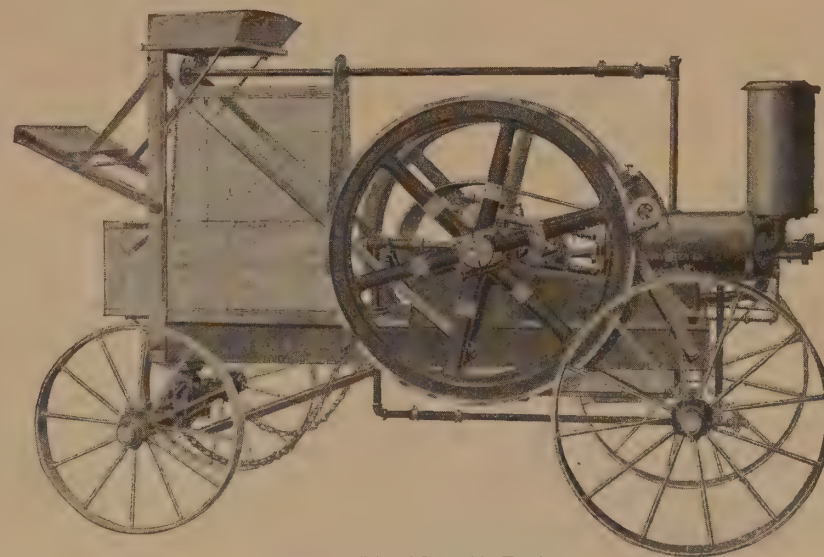
A friction pulley which bolts to the spokes of the fly wheel is provided. The power may be applied gradually, so that there is no jerking of the driven machine when starting.

SPEED CHANGING DEVICE

On the foregoing page is shown an illustration of the speed changing device for horizontal engines—stationary, portable or traction. This device gives a variation in the speed of the engine of about 100 R. P. M. The maximum speed of the engine with the device is as follows:

4-H. P. engine, 450 R. P. M.	12-H. P. engine, 340 R. P. M.
6-H. P. engine, 360 R. P. M.	15-H. P. engine, 265 R. P. M.
8-H. P. engine, 350 R. P. M.	20-H. P. engine, 255 R. P. M.
10-H. P. engine, 340 R. P. M.	

This device is of special advantage on portable engines when used to furnish power for threshing machines, shredders, saw mills, shellers, and the like. When operating these machines it is of decided advantage to be able to increase or decrease the speed of the engine according to the load. In order to remain within the safety speed limit of the fly wheel, it is necessary that this device be attached at the works where the proper adjustment of the governor can be made during the testing of the engine.



Pulley Side of Portable Engine

This device, therefore, cannot be attached to engines now in the field.

Sizes and Specifications of Portable Engines

H. P.	Tread	Size of Truck Wheels Inches	Friction Clutch Pulley		Fly Wheel		Speed R. P. M.	Approximate Shipping Weight	Equipment
			Diameter Inches	Face Inches	Diameter Inches	Face Inches			
4	44	24 and 28 x 3½	20	6½	33	2½	400	1,938 lbs.	Regular
6	46	26 and 34 x 3½	24	6½	40½	2½	325	2,483 "	Regular
8	49⅝	30 and 38 x 4	26	6½	45	3	310	3,492 "	Regular
10	49⅝	30 and 38 x 4	28	7½	49½	3	300	3,762 "	Regular
12	57⅝	30 and 38 x 6	30	9½	54	3	300	4,557 "	Regular
15	57⅝	30 and 38 x 6	36	9½	63	3	250	5,721 "	Regular
20	68	30 and 38 x 6	40	10½	60	3¾	240	6,815 "	Regular

The regular equipment of all International Harvester Company portable engines includes the following accessories:

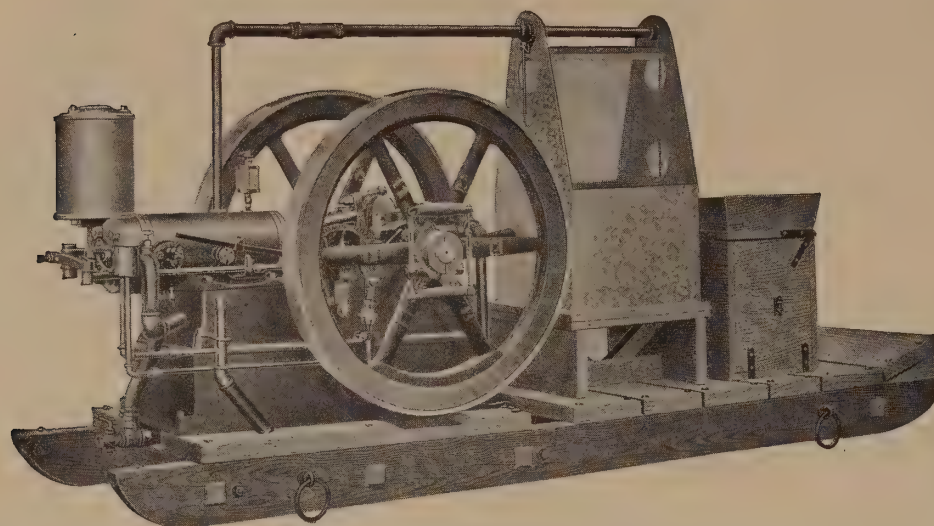
Cooling tank and pump and gasoline tank, both of which are piped to the engine, exhaust muffler, friction clutch pulley, wheel braces, singletrees, doubletrees and neckyoke, auto sparker, tool and battery box with necessary tools and batteries, and cylinder lubricator. A brake, furnished as an extra, is supplied on special order for all engines except the 4-horse power.

8-inch faced wheels can be furnished on special order for the 20-horse power portable engine truck.

These wheels, cannot, however, be furnished for engines in the field.

Famous Gasoline Engines On Skids

2, 3, 4, 6 and 8-HORSE POWER



6-Horse Power Famous Horizontal Engine

outfits. The engine, cooling arrangement and gasoline tank are all mounted on very substantial wooden skids. The gasoline tank is located in the base of the engine. The smaller 2 and 3-horse power outfits are so light that they can be carried about from place to place.

The engine proper is in all respects similar to the regular I. H. C. horizontal or vertical engine, with the exception that the gasoline tank is in the base.

The cooling engine includes a small screened tank and a circulating pump which pumps the water from the tank through the engine and then over the screen where it is cooled.

Electric ignition is used, although a hot tube can be furnished on special order which includes a small gasoline tank and burner and a hot tube. This, however, must be attached at the works, inasmuch as the cylinder must be bored to receive the tube.

Famous vertical outfits are made in 2 and 3-horse power sizes and the horizontal in 4, 6 and 8-horse power sizes.

In many instances a semi-portable outfit, such as the Famous engine, proves the best outfit. An outfit of this nature can be installed permanently for any length of time, and it can then be loaded on a farm truck or bob sled and drawn from place to place, wherever the power should be needed.

International Harvester Company Famous engines, both horizontal and vertical styles, are self-contained



3-Horse Power Famous Engine

FAMOUS MOUNTING ENGINES

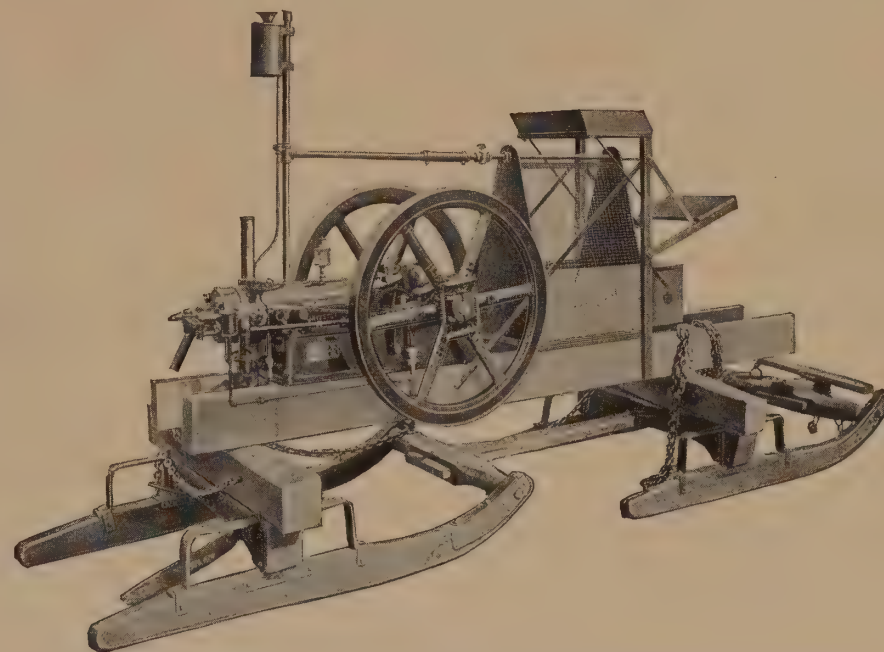
Many purchasers wish to secure a mounting outfit, that is, an engine and equipment which they can mount themselves upon a farm truck or bob sled so that it eventually becomes a regular portable outfit.

The International Harvester Company Famous mounting engine is like the regular I. H. C. vertical and horizontal engines with the exception that it contains a gasoline tank in the base of the engine and is so arranged that the purchaser can conveniently mount it to suit himself on any portable rig.

This engine can be furnished in the same sizes as the regular vertical and horizontal stationary engines.



3-Horse Power Famous Engine Mounted on a Hand Truck



This Shows how a Canadian Farmer has Mounted a Famous Mounting Engine, Equipped with Hot Tube Ignition, on a Bob Sled

HAND TRUCK FOR FAMOUS VERTICAL ENGINES

It very frequently happens that a purchaser of a small Famous vertical engine can make this serve his purpose to a better advantage by having it in a convenient, portable shape. For this reason the hand truck shown in the accompanying illustration has been produced. It is strong and yet not unduly heavy. By its use the engine can be drawn from place to place very easily by one person and without heavy lifting. This truck may be used for mounting engines now in the field by boring two holes in the skids. It is only furnished on special order.

Sizes and Specifications of Famous Engines

FAMOUS ENGINES ON SKIDS

H. P.	Type	PULLEY		FLY WHEEL		Speed	Approximate Shipping Weight	Base Measures Inches	Equipment
		Diameter Inches	Face Inches	Diameter Inches	Face Inches				
2	Ver.	8	5	24	21½	400	857 lbs.	62 x 18½	Regular
3	Ver.	9	5½	26½	21½	360	979 lbs.	63 x 21	Regular
4	Hor.	12	8½	33	2½	400	1575 lbs.	108 x 28	Regular
6	Hor.	16	12½	40½	2½	325	2028 lbs.	120 x 32	Regular
8	Hor.	18	10½	45	3	310	2677 lbs.	132 x 32	Regular

The regular equipment of Famous engines on skids includes the following: One galvanized steel gasoline tank in the base of the engine, galvanized steel cooling tank and circulating plunger pump, the whole being mounted on a substantial wooden base, one pulley, regular size, muffler, tool and battery box with tools and batteries, cylinder lubricator and oil can.

Auto-sparker, hot tube and friction clutch pulley can be furnished on special order for Famous engines.

FAMOUS MOUNTING ENGINES

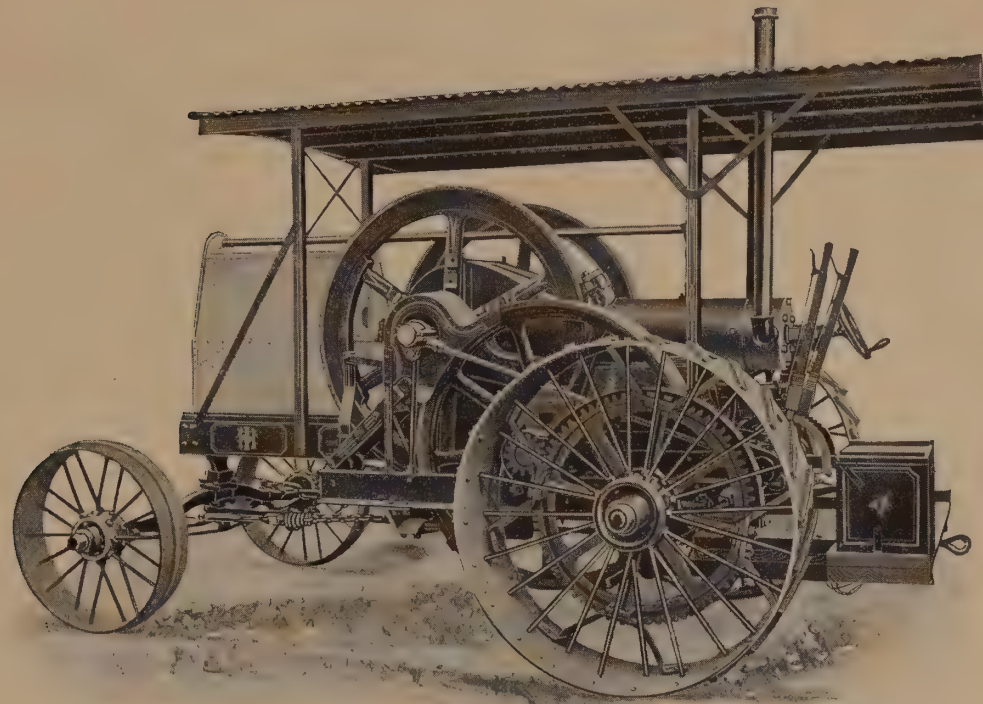
H. P.	Type	PULLEY		FLY WHEEL		Speed	Weight	Base Measures Inches	Equipment
		Diameter Inches	Face Inches	Diameter Inches	Face Inches				
2	Ver.	8	5	24	21½	400	Owing to the variation in the equipment of Famous engines for mounting by purchasers, accurate weights and base measurements cannot be given. Approximate weights and measurements, however, may be obtained by referring to the tables covering similar sized I. H. C. engines.		Regular
3	Ver.	9	5½	26½	21½	360			Regular
4	Hor.	12	8½	33	2½	400			Regular
6	Hor.	16	12½	40½	2½	325			Regular
8	Hor.	18	10½	45	3	310			Regular
10	Hor.	20	10¼	49½	3	300			Regular
12	Hor.	24	14¼	54	3	300			Regular
15	Hor.	26	12¼	63	3	250			Regular
20	Hor.	28	16¼	60	3¾	240			Regular

The regular equipment of Famous engines for mounting on skids or trucks by purchasers includes: Square galvanized steel gasoline tank, square galvanized steel cooling tank and circulating plunger pump, one pulley, regular size, one exhaust muffler with connection, tool and battery box with tools and batteries, cylinder lubricator and oil can.

Auto-sparker, friction clutch pulley and hot tube can be furnished on special order for Famous mounting engines.

International Harvester Company Gasoline Traction Engines

10, 12, 15 AND 20-HORSE POWER



20-Horse Power Tractor

The International Harvester Company gasoline tractor, here illustrated, can do anything and everything which the very best make of steam tractor can do. Besides, it is more efficient, more economical and more convenient. It operates without smoke, steam, sparks and soot blowing; without the expense of men and a team to haul water and coal, and without the loss of time raising steam. It can be run without a special licensed engineer. There is no chance of a boiler explosion, hence no necessity for ever laying up for boiler repairs.

ENGINE

The engine proper is the well known I. H. C. horizontal gasoline engine, described on pages 22 to 29 inclusive. The main frame of the truck is made from steel channels, which are very rigid and capable of withstanding severe strains. The drive wheels are 4 feet 7 inches in diameter, and on the large outfits they have an 18-inch face, provided with substantial lugs which insure good traction.

DRIVE

On the extended crank shaft of the engine is placed a pulley, made of special material, capable of producing great friction. An intermediate shaft having a pinion on each end drives the large wheels. On this shaft is a large pulley which can be brought into contact with the friction wheel on the crank shaft. The power from the engine is thus transmitted to the wheels in a flexible, yet efficient manner. The reverse is accomplished by interposing another friction wheel between the one on the crank shaft of the engine and the pulley on the countershaft.

LEVERS

Two levers, one for forward and one for reverse speed, control the application of the power. They are very simple and easily handled. The friction drive pulleys have long wearing qualities, permit the gradual starting of the truck, and quick change from forward to reverse speed without danger of stripping gears or breaking chains.

SPEED CHANGING DEVICE

The speed changing device, described on page 37, is furnished regularly on all tractors.

TRACTION POWER

On a ten per cent grade over ordinary country roads the tractors will pull the following approximate loads:

10-H. P.....	5000 to 6000 lbs.
12-H. P.....	10000 to 12000 lbs.
15-H. P.....	12000 to 14000 lbs.
20-H. P.....	14000 to 17000 lbs.

A 12 or 15-H. P. outfit will pull a Plano shredder up an ordinary hill without difficulty if the road is reasonably good—snow or mud presenting no unusually severe conditions.

WEIGHTS

The net weights of the different sizes of traction engines are as follows:

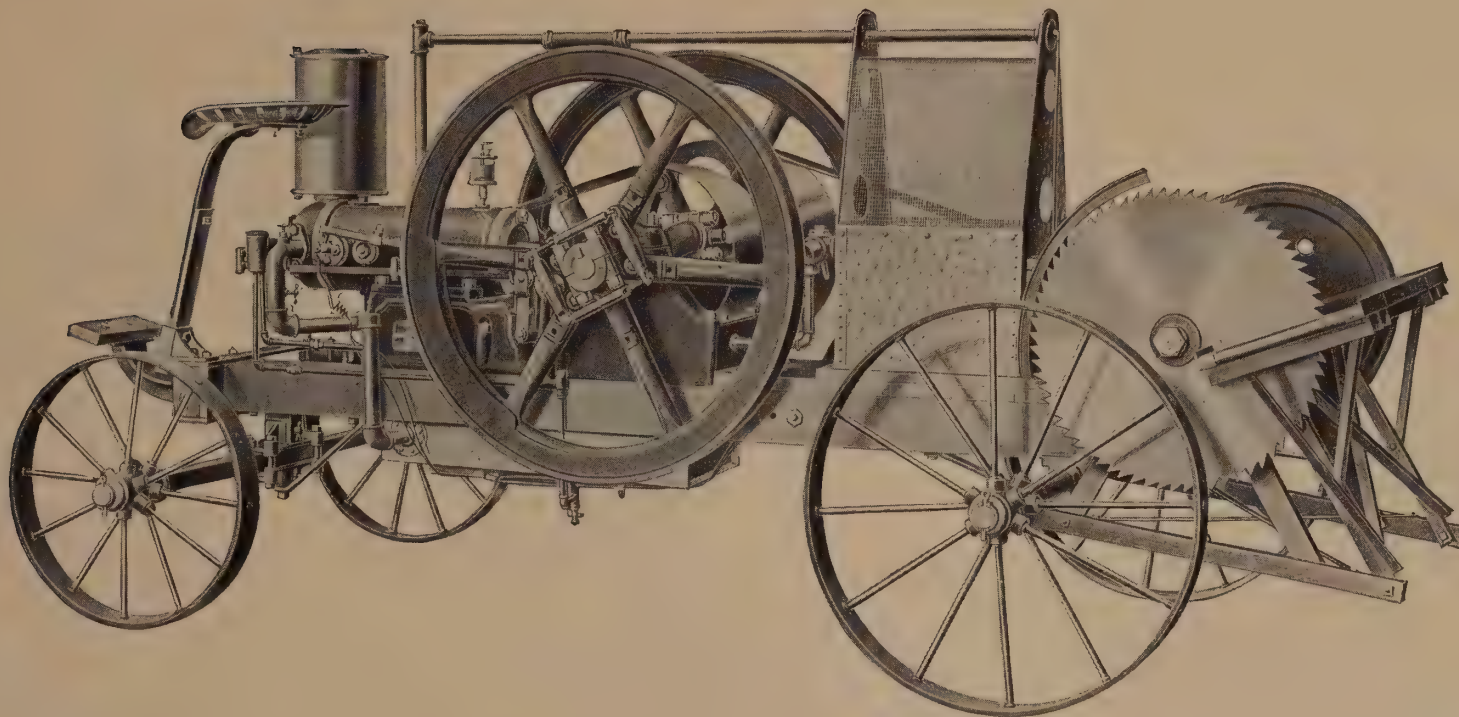
10-H. P.....	about 8000 lbs.
12-H. P.....	about 9050 lbs.
15-H. P.....	about 9850 lbs.
20-H. P.....	about 10550 lbs.



International Harvester Company 15-Horse Power Gasoline Tractor Hauling Road Grader

Famous Sawing Outfits

STEEL TRUCK



Mounted with 6-Horse Power Famous Horizontal Engine

The Famous sawing outfit consists of a Famous engine mounted on a portable steel saw truck which carries a saw. This makes a very convenient outfit, as it may be readily transported to any desirable location, and when sawing is done it can be quickly moved.

The steel saw truck is the same for three sizes of Famous saw outfits—3, 4 and 6-horse power. This steel truck includes a tilting table wood saw frame, belt tightener, seat and seat springs, doubletree and neckyoke. The truck is very substantial and neat appearing so that the Famous outfit is one of the most attractive on the market.

SPECIFICATIONS

Famous engines for mounting on the saw rig include the following accessories :

3, 4 or 6-horse power engine.

Galvanized steel gasoline tank and piping.

Galvanized steel cooling tank and plunger type circulating pump.

Exhaust muffler with connections.

Dry batteries, cylinder lubricator, oil can and tools.

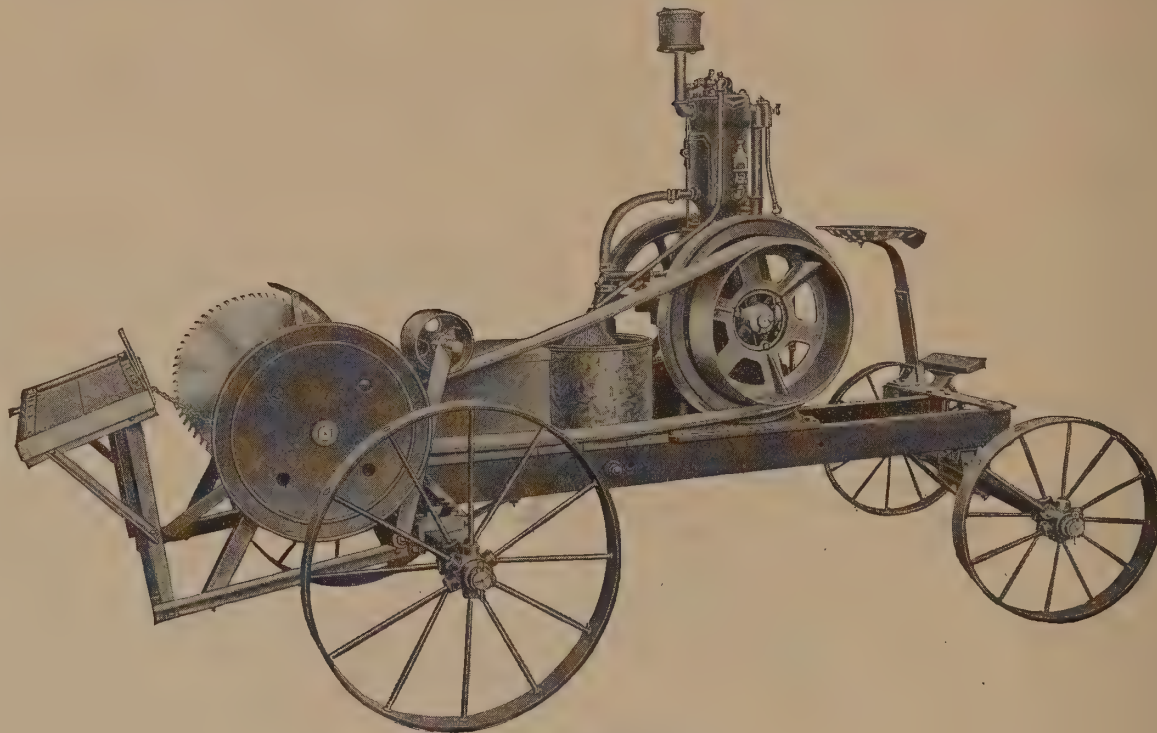
Plain pulley—20-inch for the 3-horse power engine; 18-inch for the 4-horse power engine; 22-inch for the 6-horse power engine.

Belt; belt tightener with horizontal engine only.

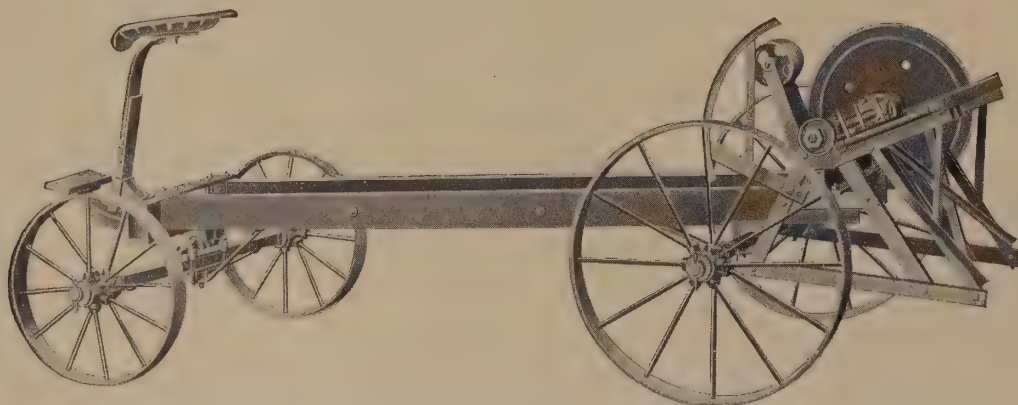
Battery box and seat.

Whiffletree and neckyoke.

Auto-sparker may be had on special order.



3-Horse Power Famous Sawing Outfit



Steel Saw Truck Without the Engine

The general dimensions of the truck are as follows:

Tread.....	56½ inches
Rear Wheels	34 x 3½-inch face
Front Wheels.....	26 x 3½-inch face
Length of Sills.....	8 feet 7 inches

Famous Spraying Engine

2-HORSE POWER VERTICAL, WATER-COOLED

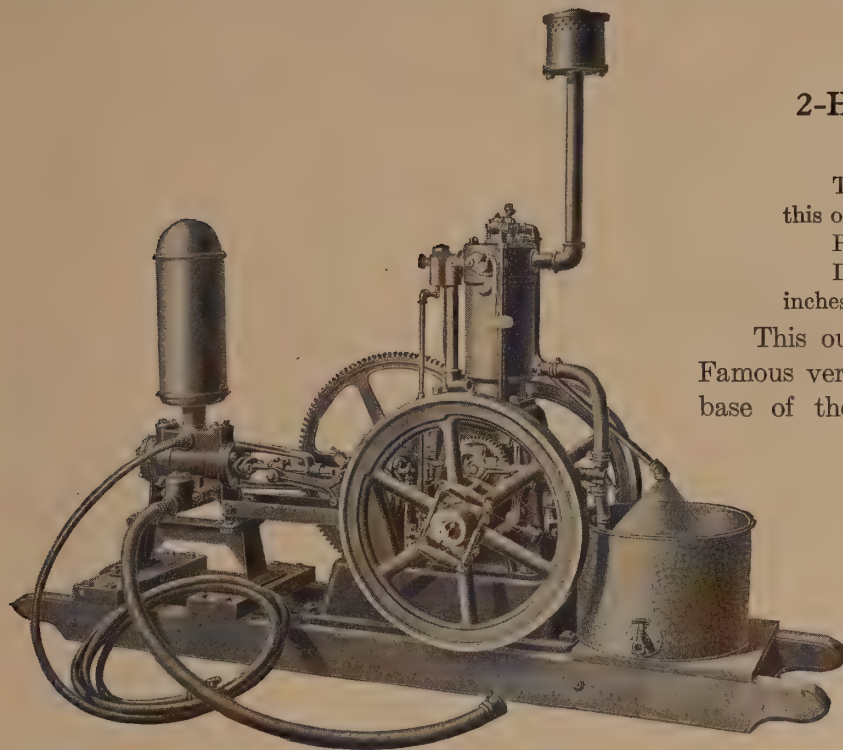
SPECIFICATIONS

The general specifications of this outfit are as follows :		Face of fly wheel, 2½ inches
Revolutions per minute, 400	gallons	Capacity of gasoline tank, 2¼
Diameter of fly wheel, 24 inches		Length of skids, 87 inches
		Width of skids, 18¼ inches

This outfit is mounted on a wooden base and consists of a 2-horse power Famous vertical gasoline engine, galvanized steel gasoline tank in the sub-base of the engine, galvanized steel cooling tank and circulating pump, regular size pulley, muffler, eccentric and connecting rod for driving spraying pump. A tool and battery box, with necessary tools, batteries and wrenches, besides cylinder lubricator, are also furnished.

The spraying pump is not included in the outfit, but must be obtained by the purchaser. As the outfit is designed and shown in the illustration a Gould double-acting sprayer outfit is used.

The engine is so equipped that the pump can be easily attached in the field if desired. It requires but a few moments'



Famous 2-Horse Power Spraying Outfit, Mounted with a Gould Double-Acting Pump

time to connect the pump to the engine. The spraying hose can be attached at either or both sides of this pump, and by providing a T connection two or three leads of hose may be used from each side, so that a farmer or fruit grower can spray two rows of trees at a time.

This spraying engine can be transported with little difficulty by mounting it on a wagon. In this way it can be drawn through orchards, and the trees conveniently and effectively sprayed.

One of the great advantages of this outfit is that the engine may be utilized for general farm purposes. In this respect the Famous outfit is far superior to other spraying outfits, which are usually so small that they can be used only for spraying purposes, and in consequence remain idle during the year with the exception of the spraying season.



Spraying in a Missouri Orchard

Vertical Air-Cooled Famous Spraying Engine

2-HORSE POWER

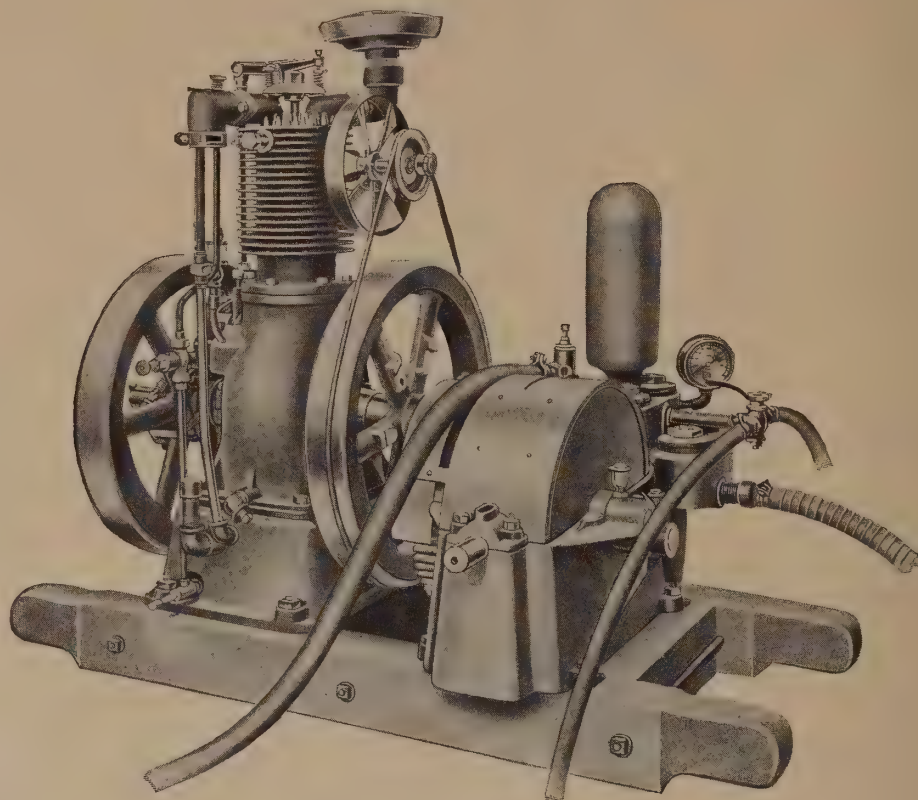
SPECIFICATIONS

The general specifications of this outfit are as follows:

Revolutions per minute, 650	Length of skids, 43 inches
Diameter of fly wheel, 17½ inches	Width of outfit, 32 inches
Face of fly wheel, 2½ inches	Weight of outfit complete with pump, about 515 pounds
Capacity of gasoline tank, 1¾ gallons	Height of outfit, 34 inches



Spraying in a New York Orchard



2-Horse Power Famous Air-Cooled Spraying Outfit

The vertical air-cooled Famous spraying engine, as shown herewith, is the 2-H. P. Famous air-cooled engine connected by gears to a Lucas spraying pump, having a cylinder,

2-inch diameter by 5-inch stroke, brass lined. The spraying engine is furnished complete with 8 feet of wire-bound suction hose with strainer, pressure gauge, relief valve, 8 feet of overflow hose, 25 feet of discharge hose, with two Vermorel nozzles, also one three-way cock, and the necessary fittings to make connections to the pump.

The sills of this engine are well stiffened by cross sills and tie bolts so that the mounting is rigid.

The outfit is comparatively light, consequently can be used with excellent success for all spraying purposes. The pump can be removed from the skids by removing four bolts, and the engine may be used for all purposes to which its limited horse power adapts it. The gearing is well covered to protect it from dirt, and to avoid accident to the operator.

Famous 1-Horse Power Spraying Outfit

MOUNTED ON FOUR WHEEL TRUCK

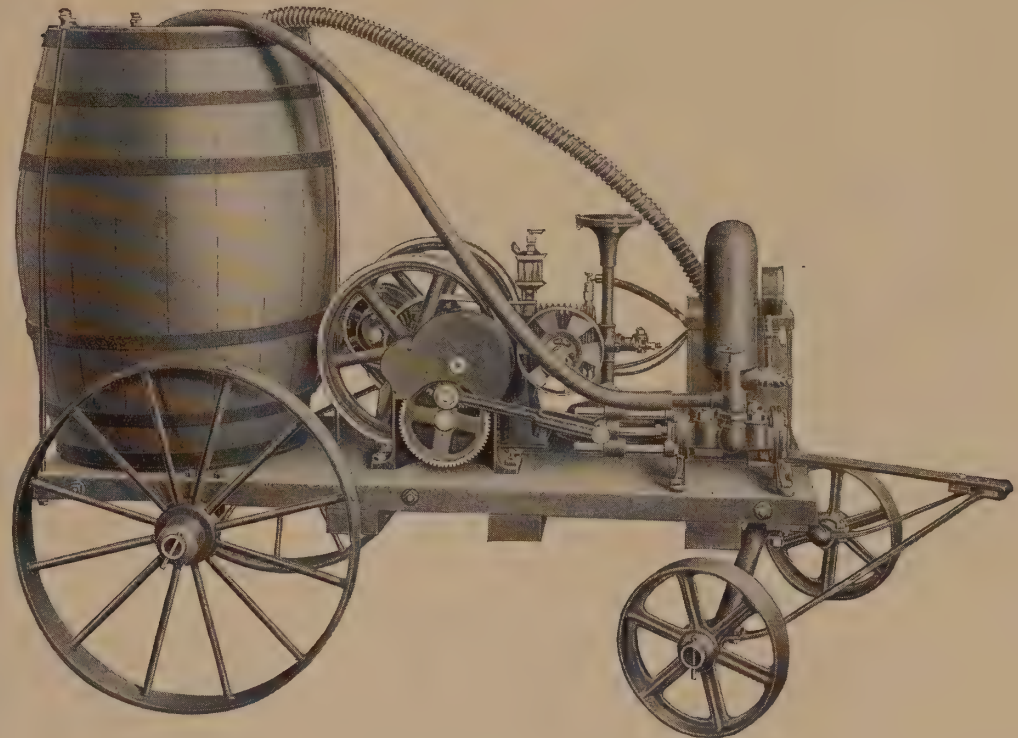
This spraying outfit is a handy little general purpose outfit. By removing only eight bolts the pumps and the connecting gears may be easily and quickly detached so that the engine can be used for innumerable purposes—operating the grindstone, separator, churn, fanning mill, washing machine, and other farm machines.

The outfit is self-contained, consisting of the Tom Thumb 1-horse power air-cooled engine mounted on a truck and connected with a Myers, Jr., pitman power spray pump, Fig. 1233. The pump has a 2-inch brass lined cylinder, $4\frac{1}{2}$ -inch stroke, ground brass seats, and brass valves. The valves are located on the side of the pump and can be reached by removing the nut immediately over them. Either valve can be removed separately without disturbing the other. The pump is provided with eight feet of overflow hose to turn the overflow back into the barrel and act as an agitator. When working two leads of discharge hose, from 60 to 80 per cent of the spray mixture will return through the overflow hose and act as an agitator.

The truck platform is 5 feet long, 21 inches of this length being allowed for mounting a barrel to carry the spray mixture. To permit this mounting three $\frac{3}{8}$ -inch holes are bored near the rear end of the platform and three $\frac{3}{8}$ -inch stay rods, 38 inches long are furnished to hold the barrel in place. This outfit is an excellent one for spraying root crops and can be drawn by horses or by hand. When two horses are used, the row is straddled, and when one horse is used it walks between the rows.

This outfit is furnished with strainer, pressure gauge, 8 feet of wire bound suction hose, 8 feet of return hose, 25 feet of $\frac{1}{2}$ -inch discharge hose, and two Vermorel nozzles. The general dimensions are as follows:

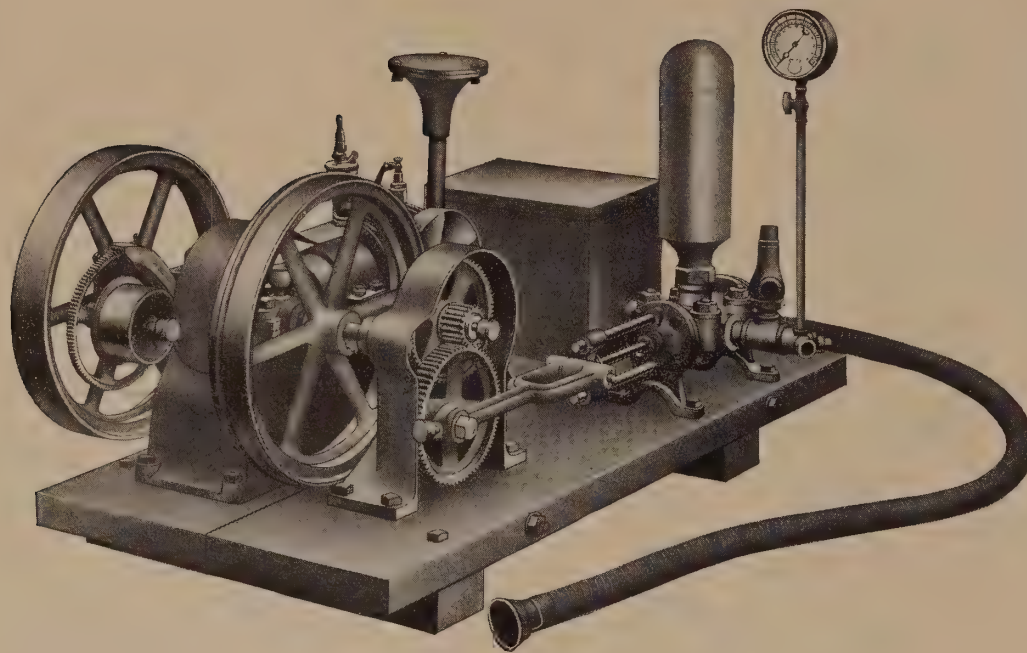
Length of truck	60	inches
Tread	$31\frac{7}{8}$	inches
Extreme Height	$38\frac{1}{2}$	inches



Famous 1-Horse Power Spraying Outfit

1-Horse Power Air-Cooled Famous Spraying Outfit

UNMOUNTED



Spraying Outfit Mounted on Platform

This spraying outfit is similar in all respects to the outfit described on the previous page, with the exception that it is not mounted on trucks and the platform is only $45\frac{1}{2}$ inches long. The engine is connected up to the same pump, however, and the outfit is furnished with the following equipment: Strainer, pressure gauge, relief valve, six feet of wire bound suction hose, and two Vermorel nozzles.

SPECIFICATIONS

Weight of engine, platform, battery box and spray pump, 328 pounds
Length of platform, $45\frac{1}{4}$ inches
Width of platform, $22\frac{1}{2}$ inches



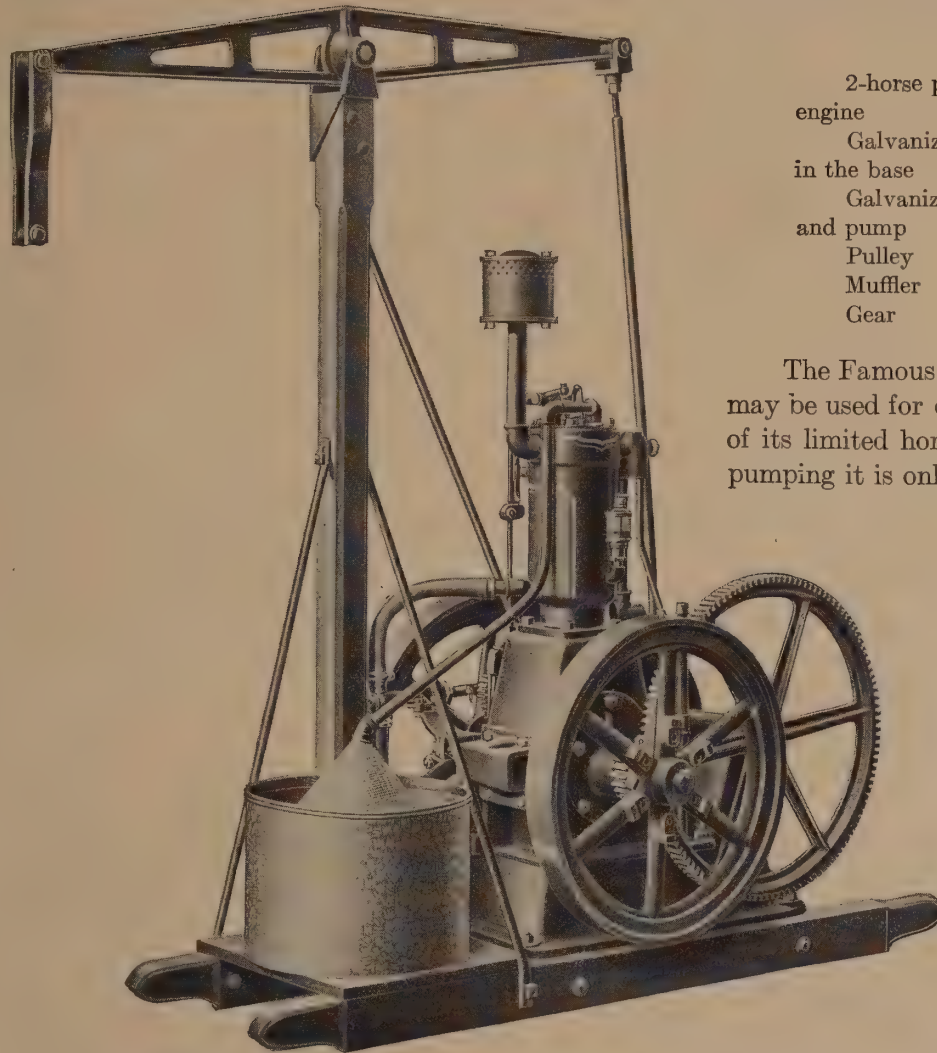
Spraying in a New York Orchard

Famous Pumping Engine

2-HORSE POWER

SPECIFICATIONS

2-horse power vertical gasoline engine	Face plate
Galvanized steel gasoline tank in the base	Steel pinion
Galvanized steel cooling tank and pump	Walking beam post
Pulley	Walking beam connecting rod
Muffler	Substantial wooden base
Gear	Tool and battery box with batteries and wrenches
	Cylinder lubricator and oil cans



2-Horse Power Famous Pumping Engine

The Famous pumping outfit is a very desirable outfit inasmuch as it may be used for other purposes, aside from pumping, to which an engine of its limited horse power is adapted. When used for purposes other than pumping it is only necessary to detach the walking beam from the pump, and belt from the pulley on the fly wheel to the machine. Inasmuch as the outfit is mounted on skids it may be easily transported from place to place.

As a pumping outfit the Famous pumping engine gives excellent service. It is a direct connected or walking beam outfit, designed especially for wells or reservoirs.

The engine is like the regular I. H. C. engine described on pages 13 to 16 inclusive, with the exception of the sub-base which, in this case, extends out and forms a support for the gears and face plate, as well as a receptacle for the gasoline tank. The gears are well constructed and are so securely attached to the base that there is no possibility of changing their position and throwing the gear teeth out of mesh.

Walking Beam Pumping Jack

This jack should not be used for pumping against a greater head than 50 feet with a $3\frac{1}{2}$ -inch cylinder, or its equivalent—a 100-foot head with a $2\frac{1}{4}$ -inch cylinder. The engine by which it is driven may be used for other purposes than pumping.

The jack is well constructed from the best grade of steel and iron and with proper care should last a lifetime. The strokes of this jack are 40 per minute, and the ratio of gears is 1 to 7.1. The diameter of the pulley is $13\frac{1}{4}$ inches with a $2\frac{3}{4}$ -inch face, and its speed is 285 revolutions per minute.



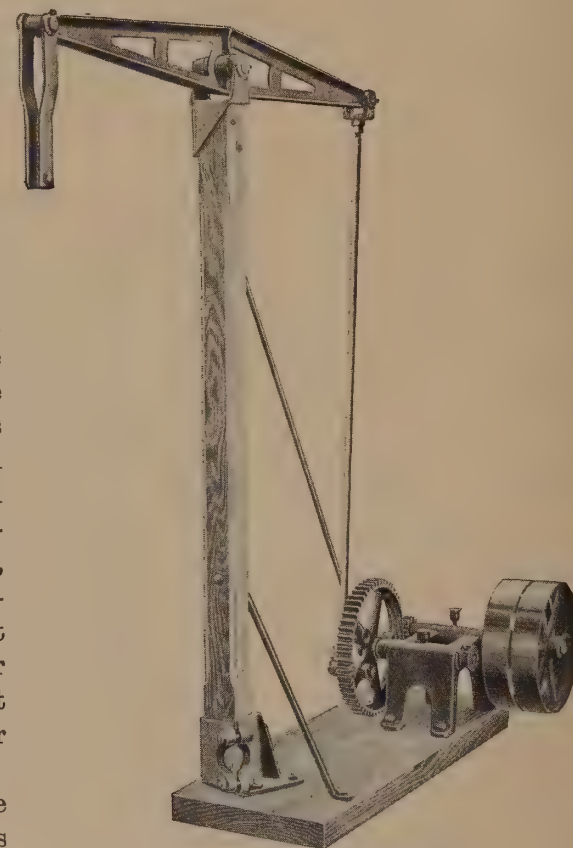
Walking Beam Pumping Jack

Walking Beam Pumping Jack No. 2

This walking beam pumping jack No. 2 is a heavier jack than the No. 1 and can be used to lift water in wells up to 200 feet in depth. The safe working load on the end of the walking beam is 1,200 lbs., which is equivalent to pumping a $4\frac{1}{2}$ -inch cylinder against a 200-foot head or a 3-inch cylinder against a 500-foot head. With a smaller cylinder, however, the head can be correspondingly increased, but it is not recommended to use this jack for wells deeper than 200 feet on account

of the number of strokes per minute, which should be reduced to about 20 for deep wells to avoid buckling of the sucker rod.

The strokes per minute are 32 to 40 and the ratio of gears is 1 to 4.66. The diameter of the pulley is 14 inches with a 3-inch face, and its speed is 185 revolutions per minute. The lengths of stroke are 5, 7 and 10 inches.



Walking Beam Pumping Jack No. 2

Regular Belted Pumping Jack

This jack is recommended for pumping against a 200-foot head with a $4\frac{1}{2}$ -inch cylinder or its equivalent—a 500-foot head with a $2\frac{1}{2}$ -inch cylinder.

With a smaller head the cylinder can be correspondingly increased. In pumping against a greater head than 200 feet the number of strokes per minute should be reduced from 40 to about 20.

The diameter of the pulley is 14 inches, face, 3 inches, speed 185 revolutions per minute. The ratio of gears is 1 to 4.66.

Heavy Belted Pumping Jack

The heavy belted pumping jack is an excellent jack for use in lifting water in wells up to 400 feet in depth. It is considerably heavier than the regular jack and has unusual strength and durability. Stockmen and farmers who have deep wells find this heavy jack very desirable. It can also be used for lifting water for small irrigation systems, gardens, etc.

The strokes of this jack are 12, 14, 15, 18 and 20 inches, and ratio of the gears is 5 to 1. The pulley is 24 inches in diameter with a $4\frac{1}{2}$ -inch face, speed 160 revolutions for 32 strokes of the pump per minute. This will vary, of course, to suit different conditions. The jack is intended to be used with engines of from 2 to 6-horse power, inclusive.

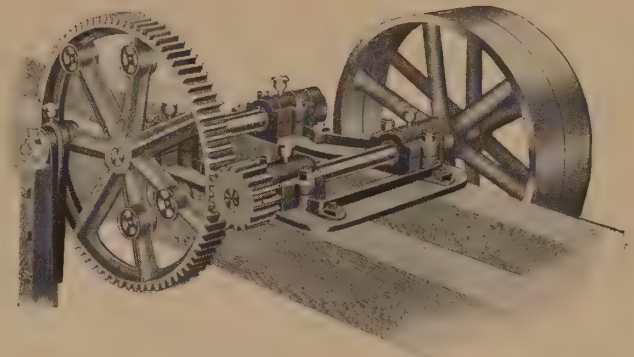
Deep Well Belted Pumping Jack

The deep well pumping jack is similar to the heavy belted jack described above, except that it is a much stronger jack and is intended to be used with engines up to and including 12-horse power. The strokes of this jack are 12, 18, 24 and 28 inches, and the ratio of the gears is 6 to 1. The pulley is 24 inches in diameter with a 6-inch face, and the speed should be 180 revolutions for 30 strokes of the pump per minute.

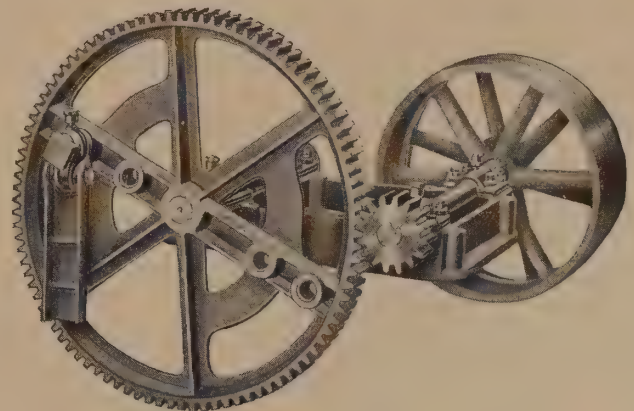
This jack is recommended for use in lifting water in wells up to 1,000 feet in depth, using a 4-inch cylinder.



Regular Belted Pumping Jack



Heavy Belted Pumping Jack



Deep Well Belted Pumping Jack

Standard Pumping Jack

These jacks are made in two sizes and are intended to attach directly to the standard of the pump. Power connection is made by belt from the engine.

The speed of the pulley of the Standard Jack is 250 revolutions per minute, the diameter, $14\frac{1}{4}$ inches and face, $2\frac{1}{2}$ inches. The ratio of the gears is 1 to 5.7, making 40 strokes per minute.

It is not intended that this jack shall pump against a greater head than 50 feet with a $3\frac{1}{2}$ -inch cylinder or the equivalent—a 100-foot head with a $2\frac{1}{4}$ -inch cylinder.

Standard Pumping Jack No. 2

The Standard Jack No. 2, which is the heavier of the two, is suitable for wells 150 to 200 feet deep. Forty strokes per minute at the normal speed of the pulley—220 R. P. M.—is the correct speed of the jack. The ratio of gears is 1 to 5.7, and the diameter of the pulley is $14\frac{1}{4}$ inches with a $2\frac{1}{2}$ -inch face. This jack is capable of transmitting 2-horse power.



Standard Pumping Jack

POWER REQUIRED TO RAISE WATER

Based on a pump efficiency of 50 per cent

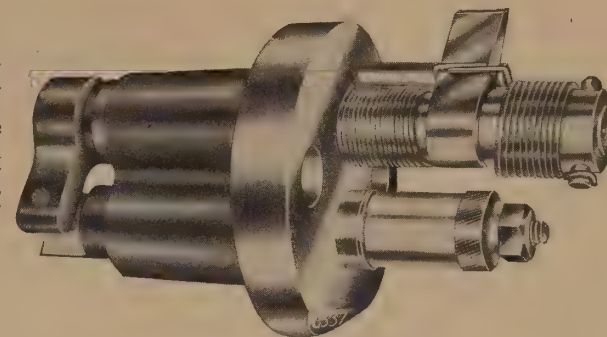
Lift in Feet	GALLONS PER MINUTE							
	$\frac{1}{2}$ -H. P.	1-H. P.	3-H. P.	5-H. P.	7-H. P.	10-H. P.	15-H. P.	20-H. P.
10	100	200	600	1000	1400	2000	3000	4000
20	50	100	300	500	700	1000	1500	2000
30	33	66	200	333	466	666	1000	1333
40	25	50	150	250	350	500	750	1000
50	20	40	120	200	280	400	600	800
60	16	33	100	166	233	333	500	666
70	14	28	85	140	200	286	420	572
80	12	25	75	125	175	250	375	500
90		22	66	111	155	222	333	444
100		20	60	100	150	200	300	400
125			48	80	112	160	240	320
150			40	66	93	133	200	266
175			33	57	80	114	171	228
200			30	50	70	100	150	200
250				40	56	80	120	160
300				33	46	66	100	133
350				28	40	57	85	114



Standard Pumping Jack No. 2

FLY WHEELS

The fly wheels are very securely attached to the crank shaft, yet they may be easily removed in case of necessity. The hubs are split and in addition to being keyed to the crank shaft are clamped by means of bolts running through the hub.



Make-and-Break Ignitor

MIXER

The opening of the nozzle inside of the air pipe is controlled by a needle valve as shown in the illustration. Connection below the nozzle is with the supply cup to the right. A rush of air through the large pipe induced by the suction stroke of the piston draws a small quantity of gasoline from the nozzle which is immediately vaporized. Thus the fuel is atomized and entirely broken up before it enters the cylinder.

The exact opening of the nozzle necessary to start the engine, and at which it should run, is marked on the dial of the needle valve so that the proper mixture is insured.

The overflow from the supply cup is carried back to the fuel tank, so that any danger from overflowing of gasoline is eliminated.



Sectional View of the Mixer Showing Air Pipe, Gasoline Nozzle and Needle Valve

IGNITOR

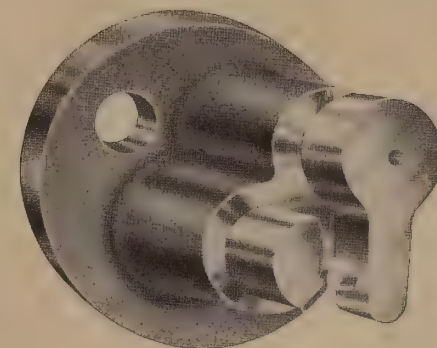
The body of the ignitor is made from cast iron, the electrodes from steel, and the ignition points from a special material capable of withstanding the heat of the spark, as well as the effects of corrosion and oxidation.

The stationary electrode is insulated and one wire from battery is fastened to it. The return circuit is made through the movable electrode and the cylinder when the points are in contact.

The forward movement of the ignitor rod on the side of the engine causes the movable electrode to come in contact with the one which is stationary. This contact is maintained for a very short time when the rod allows the movable electrode to spring back quickly, breaking the circuit and producing a spark within the cylinder.

As will be seen from the illustration the parts within the cylinder are large so that they cannot become incandescent and pre-ignite the charge.

The ignitor is directly in the path of entering charges of explosive vapor, which aids in keeping the ignitor points clean and cool. As the inlet valve opens, the mixture of gasoline and air passes the ignitor points with considerable velocity in entering the cylinder, cleaning or brushing off any soot that may have been deposited upon them. The ignitor plug may be easily removed from the cylinder when it is necessary to clean the ignitor points.



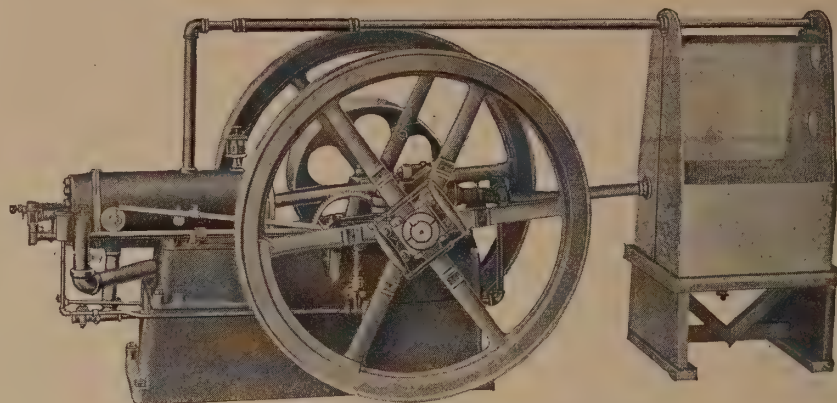
Ignitor, Showing Ignition Points

COOLING ARRANGEMENT

A water tank made of heavy corrugated iron with sufficient piping to connect it to the engine comprises the cooling outfit regularly sent with the I. H. C. engine.

SPECIAL COOLING ARRANGEMENT

The illustration on this page shows the special cooling arrangement which can be furnished on order for I. H. C. horizontal engines. The wire gauze cooling tank is small so that a few pails of water are sufficient to keep the engine cylinder from overheating. The plunger pump, which is part of the equipment, keeps the water circulating through the jacket. The pump is provided with two conveniently located drain cocks and also with a grease cup to keep the packing well greased so that it will not absorb moisture and freeze to the plunger head. The galvanized gauze or screen may be easily removed and can be renewed at slight expense. This attachment is sold as an extra and will not be furnished for engines now in the field inasmuch as it is necessary to bore holes in the engine base to take the water piping.



Horizontal Engine with Special Cooling Tank and Pump

Special Pulleys for Horizontal Engines

STATIONARY AND PORTABLE

FRICTION PULLEY								PLAIN PULLEY							
WIDTH OF FACE								WIDTH OF FACE							
Diam.	4-H. P.	6-H. P.	8-H. P.	10-H. P.	12-H. P.	15-H. P.	20-H. P.	Diam.	4-H. P.	6-H. P.	8-H. P.	10-H. P.	12-H. P.	15-H. P.	20-H. P.
14 in.	6 1/2 in.	6 1/2 in.	6 1/2 in.	6 1/2 in.	8 1/2 in.	8 1/2 in.	10 1/2 in.	8 in.	12 in.	12 in.	6 in.	12 1/4 in.	12 1/4 in.	10 in.	10 in.
16 in.	6 1/2 in.	6 1/2 in.	6 1/2 in.	6 1/2 in.	8 1/2 in.	8 1/2 in.	10 1/2 in.	10 in.	8 1/2 in.	12 1/4 in.	12 1/4 in.	12 1/4 in.	14 1/4 in.	12 1/2 in.	12 1/2 in.
18 in.	6 1/2 in.	6 1/2 in.	6 1/2 in.	6 1/2 in.	8 1/2 in.	8 1/2 in.	10 1/2 in.	14 in.	8 1/2 in.	12 1/4 in.	12 1/4 in.	12 1/4 in.	14 1/4 in.	12 1/2 in.	12 1/2 in.
20 in.	6 1/2 in.	6 1/2 in.	6 1/2 in.	6 1/2 in.	8 1/2 in.	8 1/2 in.	10 1/2 in.	16 in.	12 1/4 in.	12 1/4 in.	12 1/4 in.	12 1/4 in.	14 1/4 in.	12 1/2 in.	12 1/2 in.
22 in.	6 1/2 in.	6 1/2 in.	6 1/2 in.	6 1/2 in.	9 1/2 in.	9 1/2 in.	10 1/2 in.	18 in.	10 1/4 in.	10 1/4 in.	10 1/4 in.	10 1/4 in.	12 1/4 in.	16 1/4 in.	16 1/4 in.
24 in.	6 1/2 in.	6 1/2 in.	6 1/2 in.	6 1/2 in.	9 1/2 in.	9 1/2 in.	10 1/2 in.	20 in.	10 1/4 in.	10 1/4 in.	10 1/4 in.	10 1/4 in.	12 1/4 in.	16 1/4 in.	16 1/4 in.
26 in.	6 1/2 in.	6 1/2 in.	6 1/2 in.	6 1/2 in.	9 1/2 in.	9 1/2 in.	10 1/2 in.	22 in.	10 1/4 in.	10 1/4 in.	10 1/4 in.	10 1/4 in.	12 1/4 in.	16 1/4 in.	16 1/4 in.
28 in.	6 1/2 in.	6 1/2 in.	7 1/2 in.	7 1/2 in.	9 1/2 in.	9 1/2 in.	10 1/2 in.	24 in.	9 1/2 in.	9 1/2 in.	10 1/4 in.	10 1/4 in.	14 1/4 in.	14 1/4 in.	16 1/4 in.
30 in.	6 1/2 in.	6 1/2 in.	7 1/2 in.	7 1/2 in.	9 1/2 in.	9 1/2 in.	10 1/2 in.	26 in.	9 1/2 in.	9 1/2 in.	10 1/4 in.	10 1/4 in.	14 1/4 in.	14 1/4 in.	16 1/4 in.
32 in.	6 1/2 in.	6 1/2 in.	7 1/2 in.	7 1/2 in.	9 1/2 in.	9 1/2 in.	10 1/2 in.	28 in.	9 1/2 in.	9 1/2 in.	10 1/4 in.	10 1/4 in.	12 1/4 in.	16 1/4 in.	16 1/4 in.
34 in.	6 1/2 in.	6 1/2 in.	7 1/2 in.	7 1/2 in.	9 1/2 in.	9 1/2 in.	10 1/2 in.	30 in.	9 1/2 in.	9 1/2 in.	10 1/4 in.	10 1/4 in.	12 1/4 in.	16 1/4 in.	16 1/4 in.
36 in.	6 1/2 in.	6 1/2 in.	7 1/2 in.	7 1/2 in.	9 1/2 in.	9 1/2 in.	10 1/2 in.	32 in.	9 1/2 in.	9 1/2 in.	10 1/4 in.	10 1/4 in.	12 1/4 in.	16 1/4 in.	16 1/4 in.
38 in.	6 1/2 in.	6 1/2 in.	7 1/2 in.	7 1/2 in.	9 1/2 in.	9 1/2 in.	10 1/2 in.	34 in.	9 1/2 in.	9 1/2 in.	10 1/4 in.	10 1/4 in.	12 1/4 in.	16 1/4 in.	16 1/4 in.
40 in.	6 1/2 in.	6 1/2 in.	7 1/2 in.	7 1/2 in.	9 1/2 in.	9 1/2 in.	10 1/2 in.	36 in.	9 1/2 in.	9 1/2 in.	10 1/4 in.	10 1/4 in.	12 1/4 in.	16 1/4 in.	16 1/4 in.
42 in.	6 1/2 in.	6 1/2 in.	7 1/2 in.	7 1/2 in.	9 1/2 in.	9 1/2 in.	10 1/2 in.	38 in.	9 1/2 in.	9 1/2 in.	10 1/4 in.	10 1/4 in.	12 1/4 in.	16 1/4 in.	16 1/4 in.
					9 1/2 in.	9 1/2 in.	10 1/2 in.	40 in.	9 1/2 in.	9 1/2 in.	10 1/4 in.	10 1/4 in.	12 1/4 in.	16 1/4 in.	16 1/4 in.
					9 1/2 in.	9 1/2 in.	10 1/2 in.	42 in.	9 1/2 in.	9 1/2 in.	10 1/4 in.	10 1/4 in.	12 1/4 in.	16 1/4 in.	16 1/4 in.

Sizes and Specifications of I. H. C. Horizontal Stationary Engines

H. P.	Fuel	Mount- ing	PULLEY		FLY WHEEL		Speed R. P. M.	Approximate Shipping Weight	Floor Space Inches	Equipment
			Diameter Inches	Face Inches	Diameter Inches	Face Inches				
4	Gasoline	Cast-Iron Sub Base	12	8 $\frac{1}{2}$	33	2 $\frac{1}{2}$	400	1,405 lbs.	35 $\frac{1}{2}$ x 54 $\frac{5}{8}$	No. 1
4	Gas		12	8 $\frac{1}{2}$	33	2 $\frac{1}{2}$	400	1,335 "	35 $\frac{1}{2}$ x 54 $\frac{5}{8}$	No. 2
4	Gas and Gasoline		12	8 $\frac{1}{2}$	33	2 $\frac{1}{2}$	400	1,425 "	35 $\frac{1}{2}$ x 54 $\frac{5}{8}$	No. 3
6	Gasoline		16	12 $\frac{1}{4}$	40 $\frac{1}{2}$	2 $\frac{1}{2}$	325	1,970 "	40 $\frac{3}{8}$ x 65 $\frac{1}{8}$	No. 1
6	Gas		16	12 $\frac{1}{4}$	40 $\frac{1}{2}$	2 $\frac{1}{2}$	325	1,900 "	40 $\frac{3}{8}$ x 65 $\frac{1}{8}$	No. 2
6	Gas and Gasoline		16	12 $\frac{1}{4}$	40 $\frac{1}{2}$	2 $\frac{1}{2}$	325	1,990 "	40 $\frac{3}{8}$ x 65 $\frac{1}{8}$	No. 3
8	Gasoline		18	10 $\frac{1}{4}$	45	3	310	2,719 "	42 $\frac{7}{8}$ x 71 $\frac{3}{8}$	No. 1
8	Gas		18	10 $\frac{1}{4}$	45	3	310	2,630 "	42 $\frac{7}{8}$ x 71 $\frac{3}{8}$	No. 2
8	Gas and Gasoline		18	10 $\frac{1}{4}$	45	3	310	2,739 "	42 $\frac{7}{8}$ x 71 $\frac{3}{8}$	No. 3
10	Gasoline		20	10 $\frac{1}{4}$	49 $\frac{1}{2}$	3	300	2,949 "	43 $\frac{5}{8}$ x 77 $\frac{1}{4}$	No. 1
10	Gas		20	10 $\frac{1}{4}$	49 $\frac{1}{2}$	3	300	2,870 "	43 $\frac{5}{8}$ x 77 $\frac{1}{4}$	No. 2
10	Gas and Gasoline		20	10 $\frac{1}{4}$	49 $\frac{1}{2}$	3	300	2,970 "	43 $\frac{5}{8}$ x 77 $\frac{1}{4}$	No. 3
12	Gasoline		24	14 $\frac{1}{4}$	54	3	300	3,750 "	49 $\frac{5}{8}$ x 85 $\frac{1}{2}$	No. 1
12	Gas		24	14 $\frac{1}{4}$	54	3	300	3,675 "	49 $\frac{5}{8}$ x 85 $\frac{1}{2}$	No. 2
12	Gas and Gasoline		24	14 $\frac{1}{4}$	54	3	300	3,770 "	49 $\frac{5}{8}$ x 85 $\frac{1}{2}$	No. 3
15	Gasoline		26	12 $\frac{1}{4}$	63	3	250	5,107 "	49 $\frac{1}{4}$ x 98 $\frac{1}{2}$	No. 1
15	Gas		26	12 $\frac{1}{4}$	63	3	250	5,025 "	49 $\frac{1}{4}$ x 98 $\frac{1}{2}$	No. 2
15	Gas and Gasoline		26	12 $\frac{1}{4}$	63	3	250	5,127 "	49 $\frac{1}{4}$ x 98 $\frac{1}{2}$	No. 3
20	Gasoline		28	16 $\frac{1}{4}$	60	3 $\frac{3}{4}$	240	6,450 "	57 $\frac{1}{8}$ x 102 $\frac{3}{8}$	No. 1
20	Gas		28	16 $\frac{1}{4}$	60	3 $\frac{3}{4}$	240	6,375 "	57 $\frac{1}{8}$ x 102 $\frac{3}{8}$	No. 2
20	Gas and Gasoline		28	16 $\frac{1}{4}$	60	3 $\frac{3}{4}$	240	6,470 "	57 $\frac{1}{8}$ x 102 $\frac{3}{8}$	No. 3

The regular equipment of all I. H. C. horizontal stationary engines includes the following accessories:

No. 1. FOR GASOLINE ENGINES. One galvanized steel gasoline supply tank with two lengths of pipe and fittings to install the tank outside of the building and connect it with the engine, one galvanized steel cooling tank with pipe and fittings and rubber hose to connect it with the engine, one exhaust pot and one length of exhaust pipe, one electric battery and spark coil, one pulley, oil can, necessary wrenches and cylinder lubricator.

No. 2. FOR GAS ENGINES. Like equipment No. 1, except that gasoline tank and necessary fittings to connect to engine are omitted and gasometer added.

No. 3. FOR COMBINED GAS AND GASOLINE ENGINES. Like equipment No. 1, except gasometer added.

The I. H. C. horizontal engine is constructed so as to secure the measure of safety prescribed by the rules of the National Board of Fire Underwriters.

Gas and Combination Gas and Gasoline Attachments for I. H. C. Engines

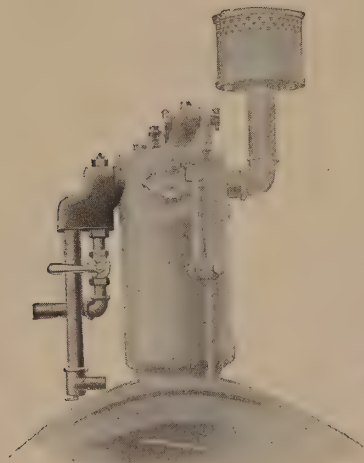
GAS ATTACHMENT

A gas attachment can be supplied for I. H. C. engines which is easily attached in place of the gasoline mixer. By the use of this attachment artificial gas may be used as fuel with excellent results. The accompanying illustrations show the gas attachment on both the vertical and horizontal engines.

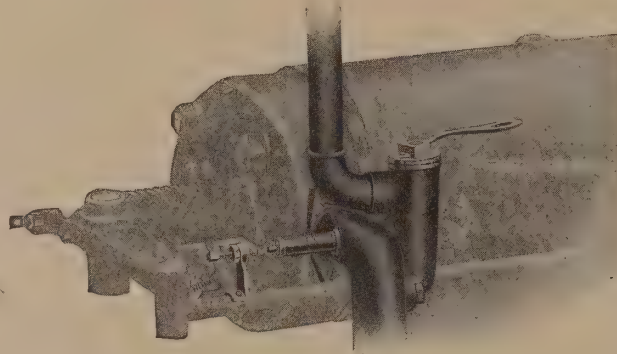
When artificial gas is to be used in an I. H. C. engine it is necessary to change the entire cylinder and piston for the reason that artificial gas has a less number of heat units than either natural gas or gasoline vapor. This makes greater compression necessary to secure the same efficiency which, in turn, requires a new cylinder and piston. Therefore, when artificial gas is to be used it should be so stated when ordering the engine so that an engine specially adapted for this fuel can be shipped.

COMBINATION GAS AND GASOLINE ATTACHMENT

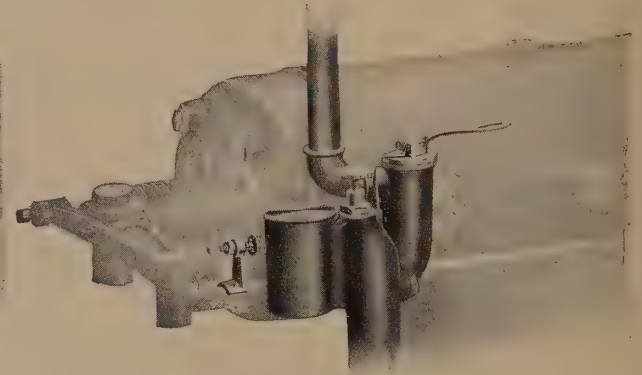
A combination gas and gasoline attachment is also furnished on special order for I. H. C. engines. This attachment has been designed especially for use in localities where natural gas is available for part of the time. It is so designed that natural gas may be entirely used as a fuel until pressure is so low that artificial vapor must be supplied, which may be accomplished by slightly opening the needle valve and allowing gasoline vapor to enter with the natural gas in order to produce an explosive mixture in the cylinder rich enough to explode, or the gas may be cut off entirely and the engine run on gasoline. No change of piston can be made with this attachment and when working with artificial gas there is a slight decrease in the power of the engine according to the quality of the gas. The change from one fuel to the other may be made instantly and without stopping the engine.



Gas Attachment on I. H. C.
Vertical Engine



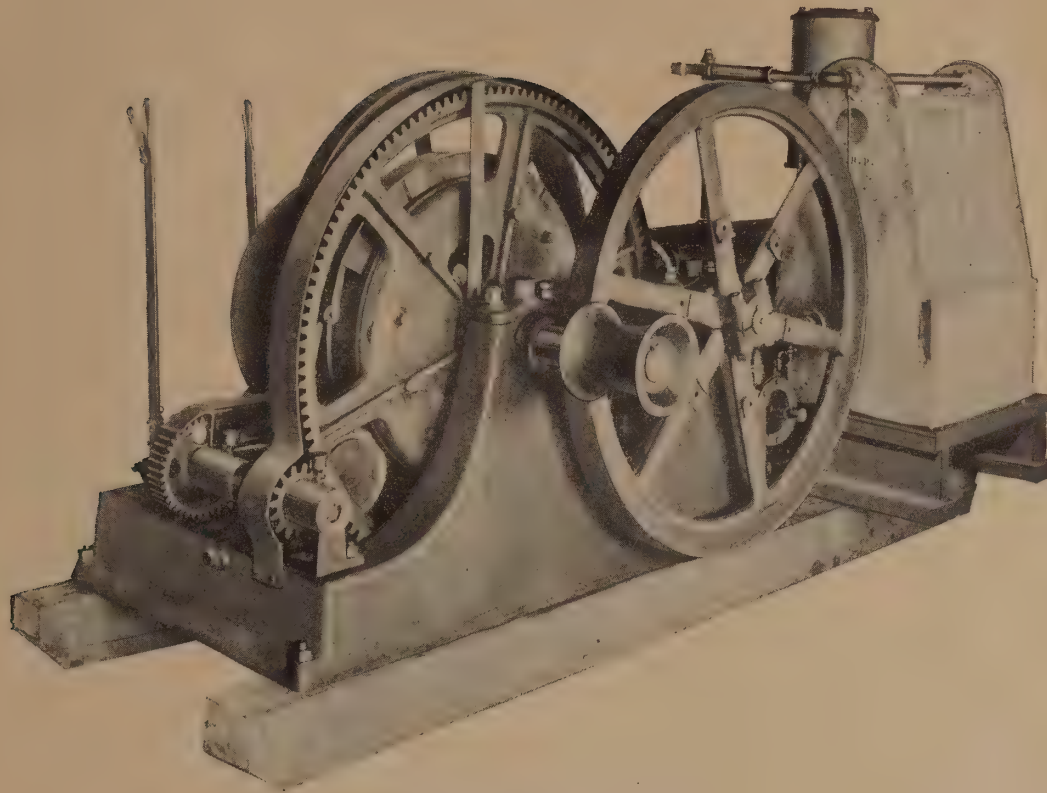
Gas Attachment on I. H. C. Horizontal Engine



Combination Gas and Gasoline Attachment on
I. H. C. Horizontal Engine

Builders' Hoist and Log Hoisting Engine

8-HORSE POWER



8-Horse Power Log Hoisting Engine

SPECIFICATIONS

Minimum revolutions per min. of drum	24
Maximum revolutions per min. of drum	37
Diameter of drum	18 in.
Face of drum	14 in.
Diameter of drum shaft	2 $\frac{3}{4}$ in.
Gear, number of teeth	126
Gear, diameter pitch	3
Gear, face	3 $\frac{1}{4}$ in.
Pinion, number of teeth	15
Floor Space, length	98 in.
Floor Space, width	60 in.

This outfit consists of a regular 8-horse power horizontal engine, with a special crank shaft, mounted on a special sub-base, which also carries a drum and reverse gear, friction clutch, speed changing device, and controlling levers. The drum shaft carries a winch. The maximum speed of the engine, with speed controlling device in, is 310 revolutions per minute; the minimum speed, with the device released, is 200 revolutions per minute. The rated load of 1,300 pounds, with single cable, can be lifted 175 feet per minute. With single cable a maximum load of 1,584 pounds can be lifted. The friction clutch and brake have ample holding

power, handling the maximum load without slipping. The hoisting device is easily handled, both in lifting and lowering.

The reverse gear is used in lowering the cable. By throwing the lever forward, this gear is put into action, the drum reversed and the cable lowered to the ground for hoisting again.

The winch has been put on the end of the drum shaft to provide a means for pulling cars. A twist or two of the rope around this winch will enable the cars to be drawn easily and quickly. This does away with the necessity of having a team standing around to pull cars from place to place.

HORSE POWER TRANSMITTED BY COLD-ROLLED SHAFTING

At different speeds Used as a line shafting Bearings 8 feet apart

DIAMETER OF SHAFT		NUMBER OF REVOLUTIONS PER MINUTE										
		100	125	150	175	200	225	250	275	300	325	350
INCHES		H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.
1 1/8		6.7	8.4	10.1	11.8	13.5	15.2	16.8	18.5	20.2	21.9	23.6
1 5/8		8.6	10.7	12.8	15	17.1	19.3	21.5	23.6	25.7	28.9	31
1 3/4		10.7	13.4	16	18.7	21.5	24.2	26.8	29.5	32.1	34.8	39
1 7/8		13.2	16.5	19.7	23	26.4	29.6	32.9	36.2	39.5	42.8	46
2		16	20	24	28	32	36	40	44	48	52	56
2 1/8		19	24	29	33	38	43	48	52	57	62	67
2 1/4		22	28	34	39	45	50	56	61	68	74	80
2 3/8		27	33	40	47	53	60	67	73	80	86	94
2 1/2		31	39	47	54	62	69	78	86	93	101	109
2 3/4		41	52	62	73	83	93	104	114	125	135	145
3		54	67	81	94	108	121	134	148	162	175	189
3 1/4		68	86	103	120	137	154	172	188	205	222	240
3 1/2		85	107	128	150	171	192	214	235	257	278	300

Example: A shaft 1 7/8 inches in diameter, making 200 revolutions per minute, is capable of transmitting 26.4-horse power.

HORSE POWER TRANSMITTED BY OPEN SINGLE BELTS

Table of horse power which may be transmitted by open single belts to pulleys running 100 revolutions per minute, the diameter of the driving and driven pulley being equal.

The horse power increases directly as the number of revolutions increases.

The horse power of double belts is ten-sevenths of that given in table.

The horse power of double belts is two-sevenths of that given in table.												
DIAMETER OF PULLEY		WIDTH OF BELT IN INCHES										
		2	2½	3	3½	4	4½	5	6	8	10	12
INCHES		H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.
6	.....	.44	.54	.65	.76	.87	.98	1.09	1.31	.....	.....	.....
8	.....	.58	.73	.87	1.02	1.16	1.31	1.45	1.75	.....	.....	.....
10	.....	.73	.91	1.09	1.27	1.45	1.63	1.81	2.18	.....	.....	.....
12	.....	.87	1.09	1.31	1.53	1.75	1.97	2.18	2.62	.....	.....	.....
14	.....	1.02	1.27	1.52	1.77	2.02	2.27	2.53	3.05	.....	.....	.....
16	.....	1.16	1.45	1.74	2.03	2.32	2.61	2.91	3.48	.....	.....	.....
18	.....	1.31	1.64	1.96	2.29	2.62	2.95	3.27	3.92	.....	.....	.....
20	.....	1.45	1.82	2.18	2.55	2.91	3.27	3.64	4.36	.....	.....	.....
22	.....	1.60	2.00	2.40	2.80	3.20	3.60	4.00	4.80	.....	.....	.....
24	.....	.....	.....	.....	.....	3.50	.....	4.40	5.20	7.00	8.70	10.50
26	.....	.....	.....	.....	.....	3.80	.....	4.70	5.70	7.60	9.50	11.30
28	.....	.....	.....	.....	.....	4.10	.....	5.10	6.10	8.10	10.20	12.20
30	.....	.....	.....	.....	.....	4.40	.....	5.40	6.60	8.70	10.90	13.10
32	.....	.....	.....	.....	.....	4.70	.....	5.80	7.00	9.30	11.60	14.00
34	.....	.....	.....	.....	.....	4.90	.....	6.20	7.40	9.90	12.40	14.80
36	.....	.....	.....	.....	.....	5.20	.....	6.50	7.80	10.50	13.10	15.70
38	.....	.....	.....	.....	.....	5.50	.....	6.90	8.30	11.00	13.80	16.60
40	.....	.....	.....	.....	.....	5.80	.....	7.30	8.70	11.60	14.60	17.50
42	.....	.....	.....	.....	.....	6.10	.....	7.60	9.20	12.20	15.30	18.20
44	.....	.....	.....	.....	.....	6.40	.....	8.00	9.60	12.80	16.00	19.20
46	.....	.....	.....	.....	.....	6.70	.....	8.40	10.00	13.40	16.00	20.10
48	.....	.....	.....	.....	.....	7.00	.....	8.80	10.40	14.00	17.40	21.00

Example: A 4-inch belt on a 20-inch pulley making 100 revolutions per minute, will transmit 2.91-horse power.

If the pulleys make 200 revolutions, it will transmit 5.81-horse power. If double belt instead of single belt is used, and the pulley makes 200 revolutions, the belts will transmit 8.3-horse power.

RULES FOR DETERMINING THE SPEED OF PULLEYS

1. To find the number of revolutions of the driven shaft when the diameter of the driving pulley and its speed are given, multiply the diameter of the driving pulley by its number of revolutions per minute, and divide the product by the diameter of the driven pulley; the quotient will be the speed of the driven pulley expressed in revolutions per minute.

Example: Driving pulley is 25 inches in diameter and makes 125 revolutions per minute. At what rate would a pulley 8 inches in diameter be driven?

$$\frac{25 \times 125}{8} = \text{Ans. } 390 \text{ revolutions per minute.}$$

2. To find the diameter of the driven pulley when the diameter and number of revolutions of the driving pulley are given, multiply the diameter of the driving pulley by the number of its revolutions, and divide the product by the number of revolutions the driven pulley is to make.

Example: What would be the diameter of the driven pulley making 390 revolutions per minute, if the driving pulley is 25 inches in diameter and makes 125 revolutions per minute?

$$\frac{25 \times 125}{390} = \text{Ans. } 8 \text{ inches in diameter.}$$

3. To find the number of revolutions of the driving pulley when its diameter and the diameter and speed of the driven pulley are given, multiply the diameter of the driven pulley by its revolutions, and divide the product by the diameter of the driving pulley; the quotient will be the speed of the driving pulley expressed in revolutions per minute. Example:

$$\frac{8 \times 390}{25} = \text{Ans. } 125 \text{ revolutions per minute.}$$

4. To find the diameter of the driving pulley, multiply the diameter of the driven pulley by the number of its revolutions per minute, and divide the product by the number of revolutions of driving shaft; the quotient will be the diameter of the driving pulley required. Example:

$$\frac{8 \times 390}{125} = \text{Ans. } 25 \text{ inches in diameter.}$$

SIMPLE RULE FOR ASCERTAINING POWER TO DRIVE PUMPS

Take number of gallons to be pumped per minute and multiply by the number of feet the water is to be raised; divide by 2,000, which will give horse power required to drive pump. This rule, however, will not apply to all pumps, from the fact that some pumps have more friction than others. A well 300 feet deep, as a rule, wastes about 50 per cent in friction in the pump. Wells deeper than 300 feet waste from 60 to 75 per cent in friction. Of course, this depends a great deal on the size of pump, cylinders, etc., used. The table on page 42 is figured on a basis of 50 per cent waste in friction.



